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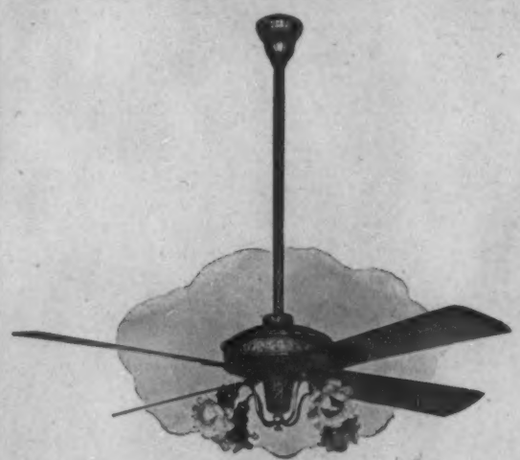

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Journal of Electricity, Power and Gas

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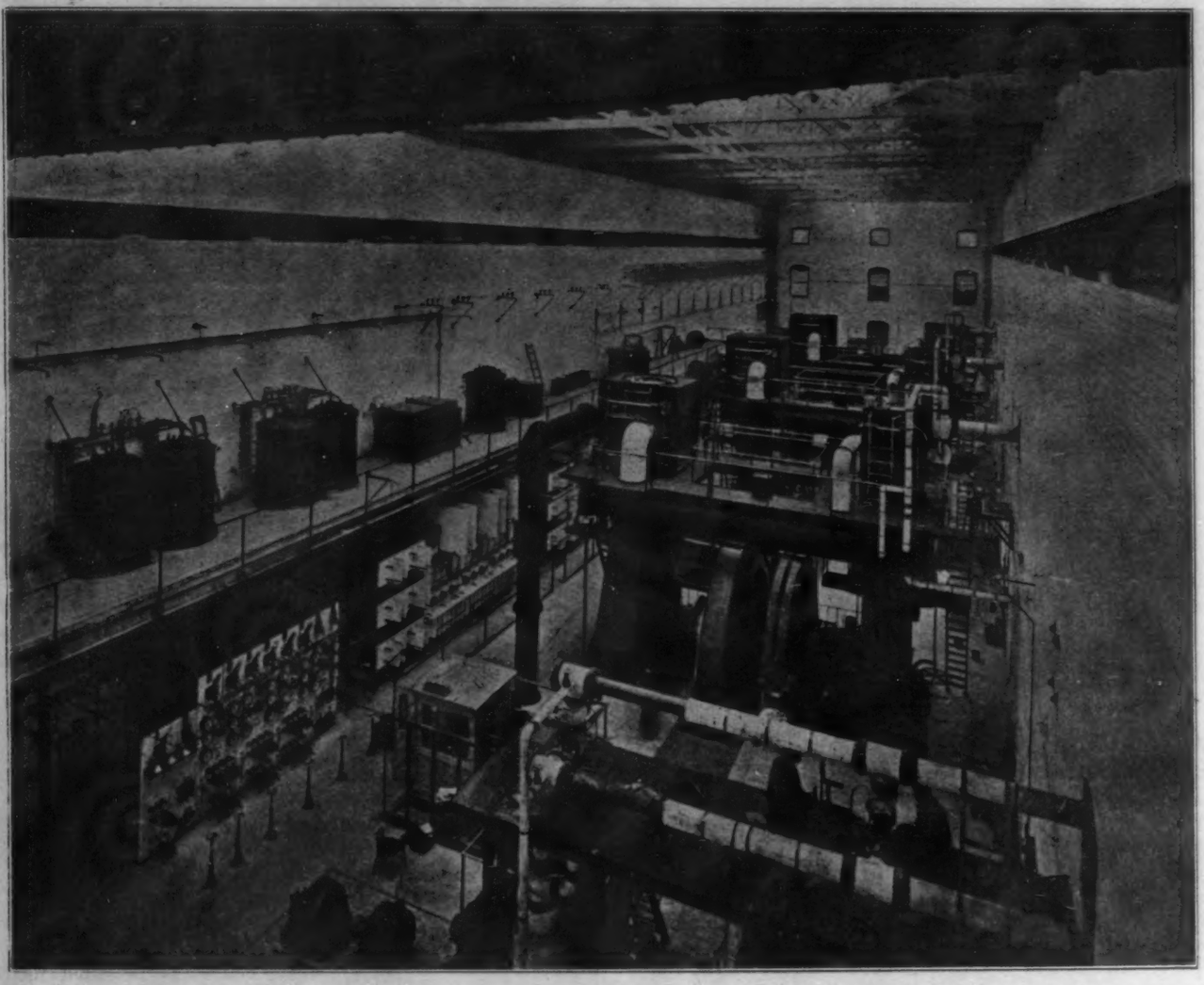
VOLUME XVIII. SAN FRANCISCO, CAL., APRIL 20, 1907 No. 16

The Recent Fire In Station "A" of the San Francisco Gas and Electric Company.

At about seven o'clock in the evening of Tuesday, April 2nd, an alarm of fire was hurriedly sent in from Station "A" of the San Francisco Gas and Electric Company. A blaze of a threatening character had been discovered on the roof of the south boiler room, and only the timely and effective action of the fire department prevented the loss of a plant valued at from eight to nine million dollars. As it was, the loss will probably not exceed $150,000, though it was feared at first that the damage to the building and machinery would amount to over two million dollars. This station is situated at Twenty-second and Georgia streets, in the Potrero district, and is the most important of the local electric stations in the system supplying San Francisco with electric power.



GENERAL VIEW STATION "A" OF THE SAN FRANCISCO GAS AND ELECTRIC COMPANY

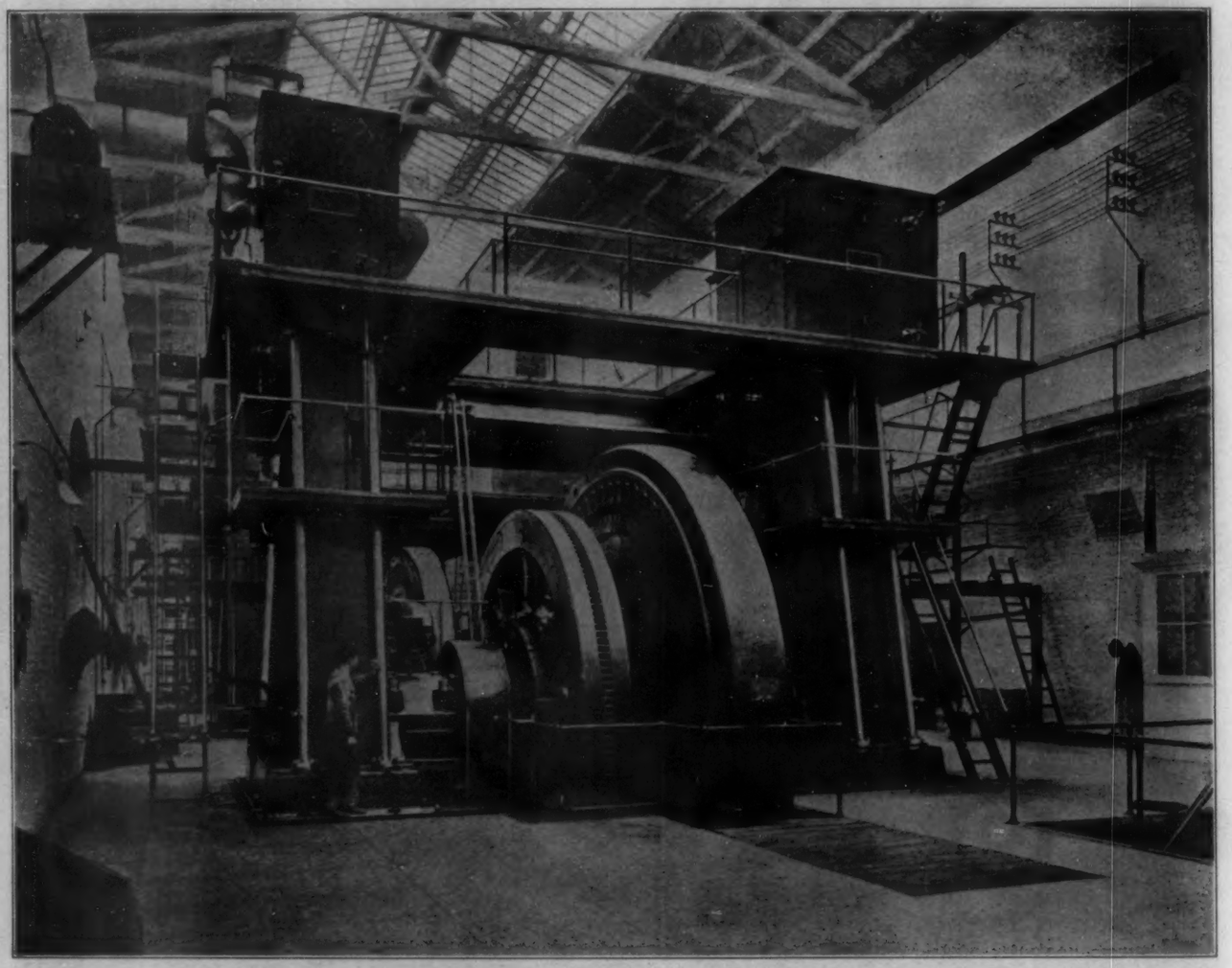
The destruction of this plant would have seriously crippled the electric lighting and power service in San Francisco, as the load is divided between this steam-driven plant and the hydraulic plants in Amador, Butte and Yuba Counties

There are installed in this plant ten direct-connected units supplying the various sub-stations for distribution about 250,000 kilowatt-hours daily.

The building is about 140 feet wide and 433 feet long, and is divided into an engine room and basement running the full length of the building and two boiler rooms. The walls are of brick. The roof was partly of glass and partly of wood covered with slate. It was at first supposed that this wood had become gradually charred by the heat from the smokestack and that the existence of conditions favorable to spontaneous combusition had caused it to burst into flame. This theory is, however, not substantiated by those who were familiar with the condition of the roof before the fire and who examined the unburned portion afterward.

off of their flanges and otherwise damaged the equipment. In the engine room the units designated by numbers from six to ten, which are under the burned portion of the roof, were temporarily put out of service. On most of these the piping and tubes were broken or bent, the gratings and railings were torn away, and various parts were so broken or strained that it has been necessary to dismantle the units to a greater or less degree.

The switchboards, switch room and feeder cables were not injured. The units numbered from one to five and the steam generating equipment in the north boiler room, which form the greater part of the original equipment of the plant, were not damaged, so that at midnight, about five hours after the fire had been discovered and before the firemen had left



ONE OF THE 1,500 KILOWATT MCINTOSH AND SEYMOUR-WESTINGHOUSE UNITS

During December of last year, owing to the great demand for power from this station, the boilers were forced to their utmost capacity and the possibility of fire was then feared. The roof was carefully watched at the time and it was found that the wood work had not been affected in any way. It is probable that the fire was started by sparks thrown out from one of the furnaces. The fire in the north boiler room on the succeeding day probably originated from smoldering wood which had been overlooked by the firemen.

With regard to the damage done the roof of the south, or new, boiler room and about ninety feet of the roof of the engine room were burned away, while other portions were so badly damaged that it will be necessary to replace them. In the fire room the intense heat and the falling timbers destroyed the pipe covering, cracked valve casings, pulled pipes

the building, it was possible to start up two of the units and throw on the usual load, which they could easily handle during the succeeding period of light demand.

As soon as the firemen arrived, it was of course necessary to shut down the plant, but before doing this the greater part of the load was transferred to the transmission lines from the hydraulic plants and to the reserve gas-driven units in the Martin power plant.

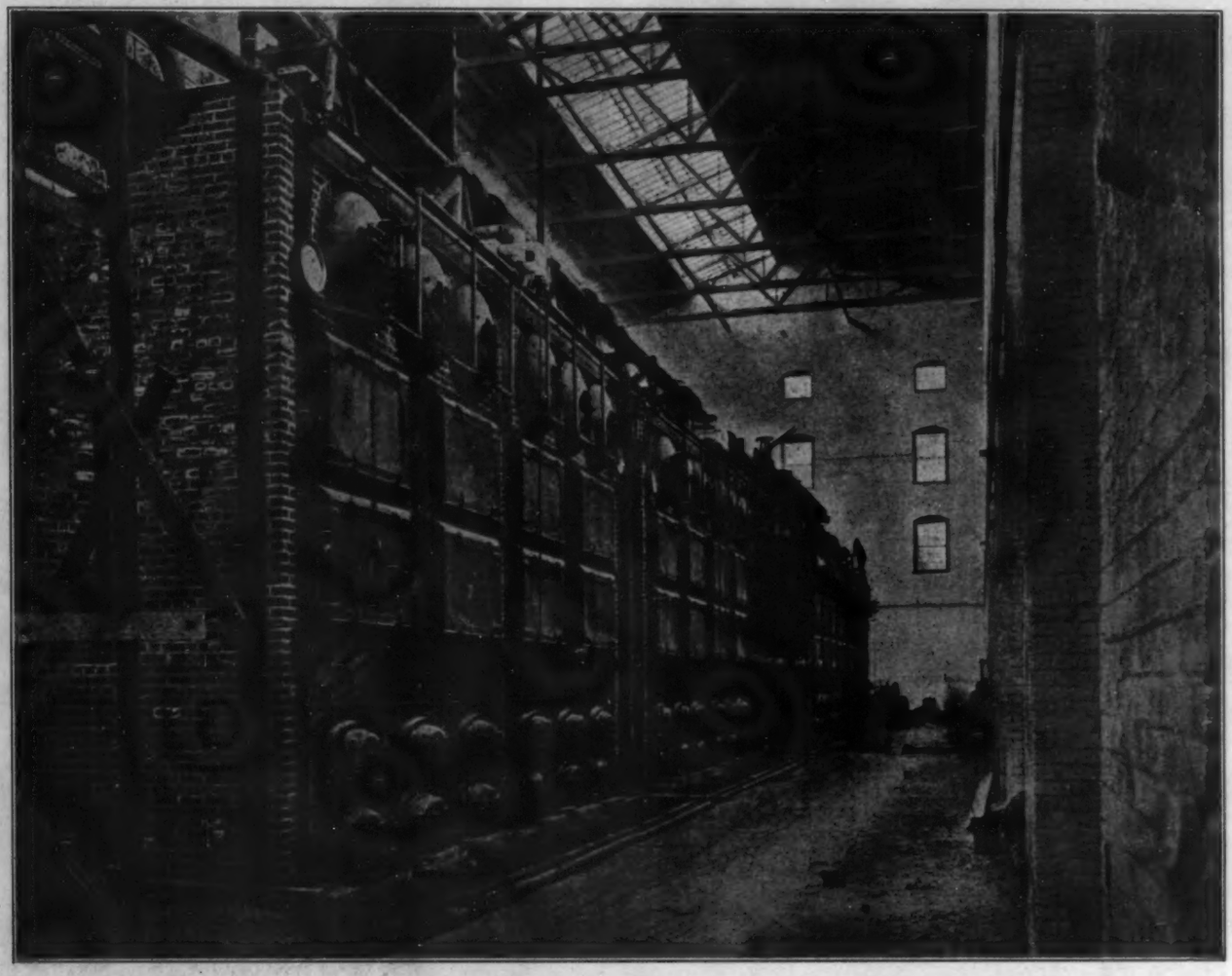
At about 11:30 p. m., at which time the fire was nearly out, the exciter set in the north end of the building was started and a little later one of the engines was started up with atmospheric exhaust. Several of the lighting circuits in the building were connected in as it was deemed advisable to test out for short circuits while the firemen were still in the vicinity. As soon as electric power was available for

operating the motor-driven circulating pumps for the condensers, an additional unit was started up and both engines were run condensing. The load was then gradually thrown on.

While the firemen were carrying on their battle with the flames, messages were hurriedly sent to the operating engineers from other stations of the company, and employees were sent out to gather up a large force of men. As soon as practicable the men were divided into gangs and began the work of clearing away the debris. In a remarkably short space of time the fallen timbers and other wreckage were carried out. Under the direction of the engineers the work of examining and repairing the damaged equipment was undertaken as soon as conditions would permit.

Electric Light and Power Company and was later purchased and its capacity more than doubled by the San Francisco Gas and Electric Company. The older units consist of five McIntosh and Seymour vertical cross-compound engines direct connected to Westinghouse alternators supplying current at 500 volts and having an aggregate capacity of about 7,500 kilowatts. This older equipment was fully described in The Journal for December, 1901. At the time of its installation it was considered one of the most modern plants in America and though practice and operating conditions have changed considerably since then, it compares very favorably in many respects with the installations of the present time.

The new equipment, however, conforms to the most modern practice in the selection of machinery for large power



TRANSVERSE SECTION OF THE PLANT

All efforts were devoted to getting the plant ready for immediate operation and much of the work done is therefore only of a temporary character. The greater part of the required materials was necessarily taken from the most available sources. Owing to the scarcity of copper gaskets rubber gaskets had to be used instead.

On the following day after the fire, all the districts in San Francisco were receiving their normal amount of power, and on Friday morning, two days later, all the units were in operation but one. The generators in the exposed part of the building are protected from falling mist by large canvas coverings.

The northern half of Station "A" and most of the equipment installed therein was built in 1901 for the Independent

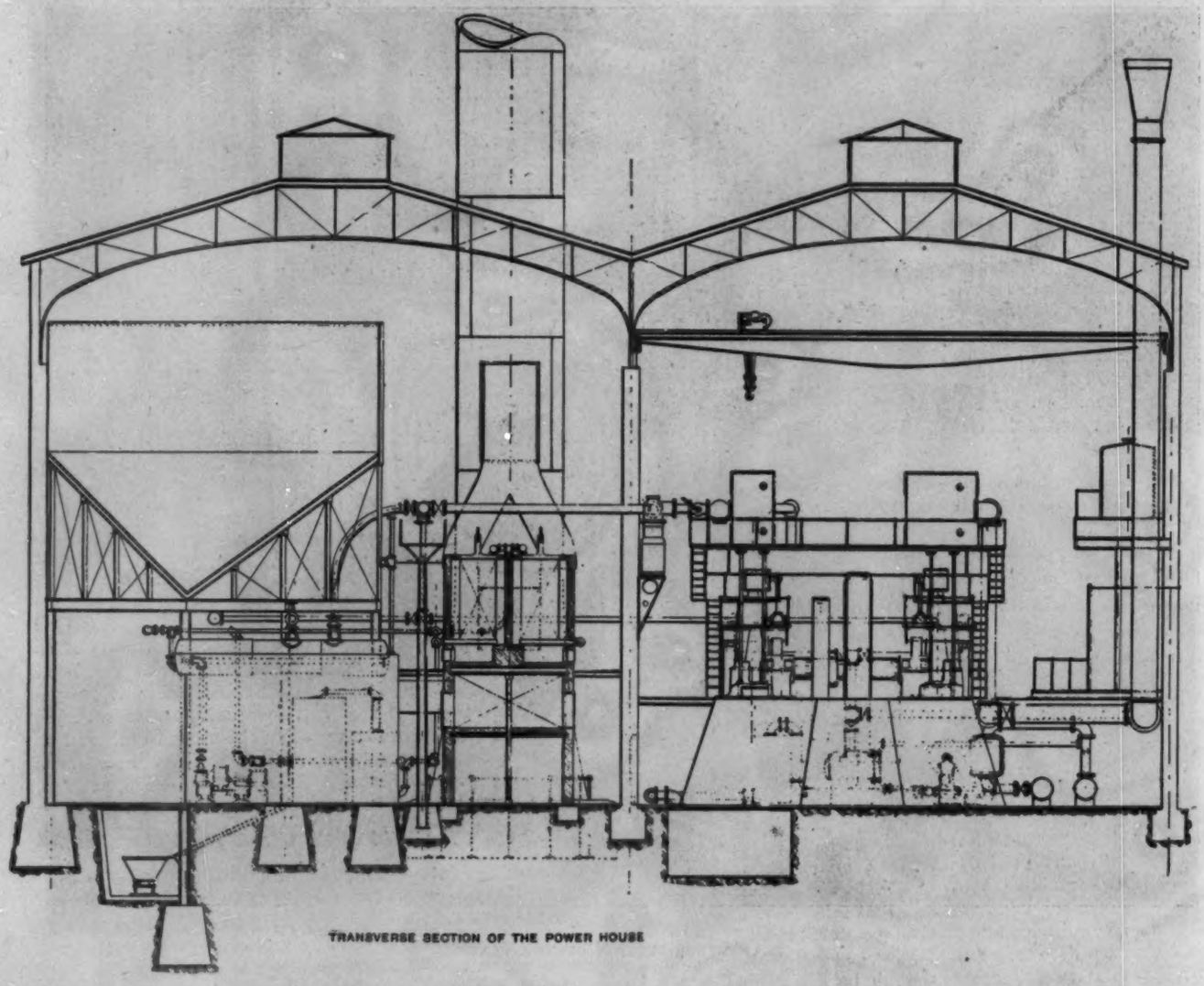
stations. The new generating units are five in number. The engines are all of the vertical type and are operated by steam at 185 pounds pressure, with a normal superheat of about 125 degrees Fahrenheit. Direct-connected to these are three-phase, revolving field, 60-cycle alternators which supply current at 11,000 volts to underground feeder cables running to the various distributing sub-stations.

No. 6 unit consists of a McIntosh and Seymour cross-compound engine of dimensions 28x58x48 inches driving a 1,500 K. W. Westinghouse alternator. The remaining four engines are of the triple expansion type and were built especially for this plant by the Union Iron Works. The engines for units Nos. 7 and 8 are of dimensions 24x36x54x36 inches. The alternators are also 1,500 K. W. machines of the West-

inghouse manufacture. Units Nos. 9 and 10 each have a capacity of 3,500 K. W. The engines are of dimensions 36x66x90x 48 inches. The alternators were built by the General Electric Company.

The Wheeler "Admiralty" surface condensers are used. These ordinarily give a vacuum of about 27 inches of mercury. In connection with the condenser for the McIntosh and Seymour engine an Edwards three-throw air pump driven by a 50 horsepower, three-phase induction motor is used. The air-pumps for the triple-expansion engines are built within the engine frame, the pistons being actuated by a link motion operated from the cross-heads of the high pressure cylinders.

steam at 185 pounds pressure with a superheat of about 125 degrees. The Heine boilers, each of which is rated at 500-horsepower, are set in one battery, the furnace gases passing into a single Heine steel stack 96 inches in diameter and 100 feet high. The Babcock and Wilcox boilers, which have a rated capacity of 780 horsepower each, are set in two batteries of six and three boilers respectively. The furnaces are connected to three 72-inch Babcock and Wilcox steel smokestacks also 100 feet high. The furnaces are oil burning, the Wilgus burner being used with the Heine boilers and the Hunt-Mirk burner with the Babcock and Wilcox boilers.



TRANSVERSE SECTION OF THE POWER HOUSE

The circulating water is supplied from the San Francisco Bay by four Byron Jackson, single-stage, centrifugal pumps located in a pump house situated about 1,500 feet from the plant. Three of these are direct-connected to 100 horsepower, 500-volt, 3-phase induction motors; and the fourth, which is much larger, is driven by a 350-horsepower, 11,000-volt, 3-phase synchronous motor. The smaller pumps have 16-inch suction pipes and the larger pump a 30-inch suction pipe. The four pumps feed into a single 36-inch main. The discharge from the condensers runs back to the Bay by the force of gravity.

The new boiler equipment consists of six Heine and nine Babcock and Wilcox water-tube boilers which generate

The feed water and oil pumps are located in the southwest corner of the new boiler room. There are two tandem, duplex, Snow feed-water pumps 12x19x10x18 inches, and two Snow oil pumps 8x5x10 inches. Goubert heaters and Green economizers are used.

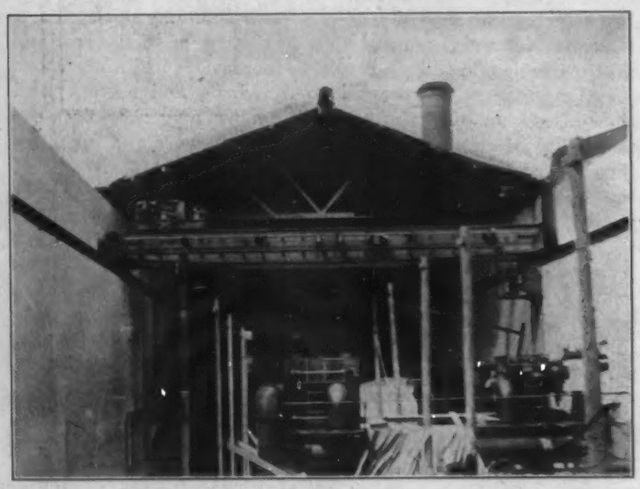
For the storage of fuel oil there are three riveted steel tanks, two of which have a capacity of 25,000 barrels each and the third a capacity of 10,000 barrels. These tanks are located near the water's edge and are filled directly from oil barges.

One of the interesting features of this plant is the lubricating oil system. The apparatus is kept in a special oil room, which occupies half of a small corrugated iron house

built apart from the main building. The oil after passing through the bearings of the engines flows by gravity into a receiver tank placed in the basement below the engine room. From there it is pumped by a Dow 3x2x3 inch pump to a settling tank, which is the middle one of five tanks set in a row. In this tank the oil and accumulated water and foreign matter are allowed to settle until they are well separated. The oil is then drawn off through a strainer into a receiving tank from which it is pumped by another Dow pump to either of the two kettles on the right and left of the settling tank. Live steam is circulated through the iron steam coil in the

THE NEW BOILER ROOM SHOWING THE CONDITION OF THE PIPE COVERING AFTER THE FIRE

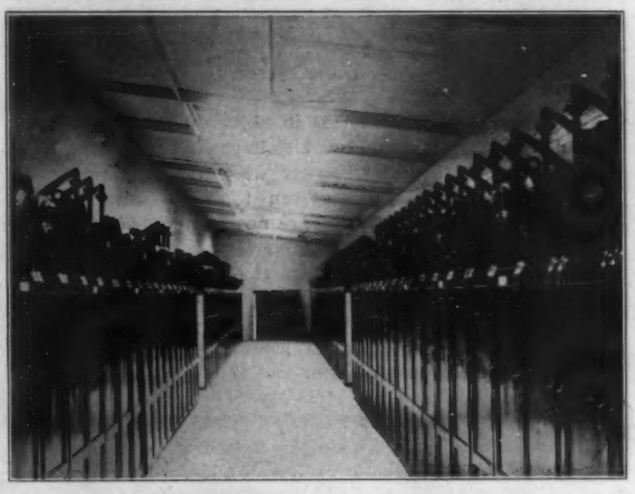
kettle until the separation is practically complete. The oil is allowed to cool and is then drawn off into one of four supply tanks placed on the floor or, if these are full, into the storage single main running to the engine room. Within the tanks a pressure of about sixty pounds is maintained by connection



FIVE-TON ELECTRIC CRANE AND VIEW OF ENGINE ROOM AFTER THE FIRE

tanks on the right and left of the steam kettle. The supply tanks have a capacity of 145 gallons each and feed into a with a steam-driven air compressor, so that the oilers can get their oil from the distributing pipes by merely manipulating a valve or cock.

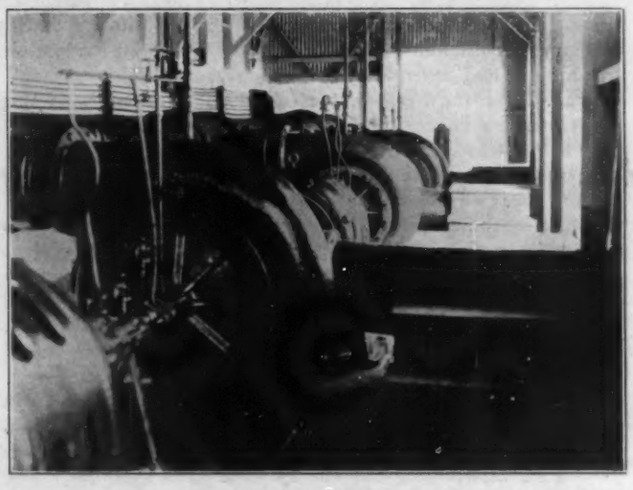
The Shaw electric girder crane shown in the photo-



THE SWITCH ROOM SHOWING THE REMOTE MOTOR-CONTROLLED OIL SWITCHES

graph was in constant use during the repairs to the damaged engines. It has a capacity of 10,000 pounds.

This electric power station is operated entirely for the generation of power. The distribution at the required voltages is accomplished from sub-stations placed in various parts of the city. In the switch room shown in one of the photo-



CENTRIFUGAL PUMPS DRIVEN BY INDUCTION MOTORS. THESE SUPPLY WATER TO THE CONDENSERS

graphs there are thirty-eight general electric, remote motor-control, oil switches connected to the double sets of bus-bars, there being two switches for each of the ten generating units and two for each of the nine feeder cables.

It is intended to avoid the repetition of the recent fire from a similar cause by the construction of a fireproof steel and re-inforced concrete roof.

The Pacific States Telephone and Telegraph Company in name no longer exists. It is the Pacific Telephone and Telegraph Company, according to advices received by the Spokane office. The Pacific States absorbed the Sunset Telephone and Telegraph Company early this year, both corporations being known as the Pacific Telephone and Telegraph Company. The change of name, however, did not apply to the lines in Idaho, for the head office instructed the Idaho offices to continue using the word "States." Now comes word to drop the word "States" and confine to the name Pacific Telephone and Telegraph Company.

MOTORS FOR MACHINES AND TOOLS.*

Substitution of Electric Drive for Steam Drive or Water Drive by Belting and Shafting—Consideration of the Fire Dangers—Advantages of the Use of Electricity in Mills and Workshops.

By Dana Pierce.

The use of electric motors in mills and shops is now so general that there is some difficulty in realizing how few years have passed since electric power was first used for manufacturing purposes. Motor-driven tools and motor-driven machinery of every discription are now common enough, and although a machine shop, a cotton mill or a printing house make less appeal to popular interest than telephones, trolley lines and wireless telegraphy, it is yet true that, in none of its multifarious applications, has electricity brought about more important or more radical changes than in the operation of great and small factories and shops by the sturdy and accommodating electric motor.

It is neither necessary nor appropriate here to discuss in detail all of the advantages of electric drive over belts and shafting. Arguments that were novel once are commonplace now. Ease and economy of power transmission, flexibility both in installation of machines and in their operation, increase of output, resulting from uniform speed or from instantaneous and exactly controllable speed variations, and above all, efficiency, both mechanical and commercial, and other advantages have been investigated thoroughly and have been demonstrated satisfactorily by experience in numerous and widely dissimilar classes of service.

Thirteen years ago the first textile mill was equipped to employ electric drive on a large scale. The development of the art has been so rapid that today, not only in the textile industry, but in almost every other kind of manufacture, electric motors find extensive use in shops both large and small. It may, therefore, be desirable to consider the effect of this great increase in the use of motors upon the fire hazard. It may be well to recall here the oft-repeated fact that electric generators, wiring and motors are simply means of transmitting energy from steam engine or water wheel to loom or lathe or machine tool. The electric system of itself creates nothing. On the physical side, the question, therefore, evolves itself into a consideration of the comparative dangers attending the transmission and control of energy by electrical and other means, and, since energy always transforms itself sooner or later into heat, we have to guard against the development anywhere of an excess of heat which may cause a fire.

The prime mover in every system is either an engine or a water wheel and, if these are housed in the factory building, they present the same hazard, whatever means may be employed for distributing the energy developed by them. But, with electrical distribution of the power, it is not necessary that the prime mover be placed near the machinery it is to drive. Boilers and engines or water wheels need not be either in the main factory building or an extension to it, but may be placed in an entirely separate structure located in the most advantageous place at almost any distance from the factory proper. The power house can then be constructed in a manner to be thoroughly safeguarded, and thus it will cease to be a factor in the fire hazard of the rest of the plant. While considerations of convenience and expense are doubtless the controlling factors in the design of the plant, the possibility of thus isolating the power house from the other buildings is a factor of great importance in considering the fire hazard.

The modern electric generator and its controlling apparatus are now so thoroughly well designed that, when properly installed, their presence in a suitably arranged power house need not add materially to the fire risk of that building, especially as compared with the necessary boilers with their fires and flues. The principal risk in a generator room is probably from the wires, where a large number are brought close together, especially about the switchboard. But, where the wires have a tight, non-combustible cover, as required by the National Electrical Code, and are well insulated and supported by the use of non-combustible materials, this hazard can be reduced to a minimum for normal operating conditions, even with a large group of wires.

The foregoing considerations apply to factories that have their own dynamos. If, however, energy is derived from a source wholly outside of the plant, as a central station, an advantage results from the entire elimination of engines, boilers, coal and their attendant dangers. In a factory operated by electrical energy supplied from a remote station, we have only the hazards incident to the distribution of the power—that is, the wiring systems and the motors.

Without knowing the exact amount of the account to charge up against boilers, flues and overheated bearings, we know that it contains a number of important items, and, therefore, when a mill does away with all of these hazards by the introduction of electricity, with energy supplied from some outside source, the insurance man considers that a right step has been taken and looks to see how much should be charged up in fire losses to the form of energy substituted.

The National Electrical Code sums up in its rules for installation the combined experience of manufacturers, users of electric appliances, insurance bureaus and inspectors and the results of years of experience and observation. While by no means perfect or final, these rules undoubtedly afford the best available standard of present practice, and compliance with their requirements produces an installation as thoroughly safe as is possible at the present state of the art. It is, therefore, possible now to arrange wiring and motors in a manner to insure the minimum risk, and, in general, the larger the equipment the better it is likely to be, because motives of economy and efficiency will, for a large plant, prescribe more careful engineering in the design of the equipment and greater skill on the part of those who supervise its use and maintenance than are employed usually in smaller establishments.

Electric drive will not, of course, remove all of the fire hazard from the power distribution equipment, but it is true that there is no longer good reason for considering the presence of a well-designed and properly installed system of electric drive a serious factor in the fire hazard of a plant, and there is still less justification for the use in such equipments of fittings, apparatus or methods of wiring which experience has shown to be hazardous. A narrow economy in first costs is unwise from the point of view of the owner of the risk and is properly penalized by a resulting increase of insurance rates.

Coming now to comparison of wiring and motors with the old system of shafts and belting, we may note first the possibility of eliminating altogether belt-towers and openings through partitions and floors for belting and shafting. It thus becomes possible to construct buildings with fewer breaks in floors and fire walls. Every reduction of the number and area of openings through floors and partition walls makes it possible to more completely protect each room. The necessary passages and doorways can be protected by fire doors of approved patterns, and fireproof floors retain their full value. Belt boxes are natural traps for dust and rubbish and are not infrequently set on fire by the friction of slack belts against the wooden surfaces.

Wherever shafting is used there is the hazard of heating effect, produced by undue friction at bearings or pulleys, a hazard which may be minimized but not entirely eliminated. The following paragraphs quoted from an article by S. B. Perry in the quarterly bulletin of the National Fire Protection Association, July, 1906, express clearly the possible dangers.

"Among the many sources of excessive friction attending the use of shafting lines and belts for power transmission are journals and bearings out of alignment, or out of round, due to improper fitting or materials, poor lubrication,

*From "Insurance Engineering."

loose bushings in wood pulleys, pulleys overloaded or out of balance, belts frayed or in contact with woodwork, belts slipping on wood rims, etc.

"With respect to the pulley, three kinds are common—steel or iron, wood, and steel spider with wood rim. In the iron pulley the hazard of heating is absent, except in that type known as the 'loose pulley,' which is used in belt shifting, and is practically a journal box or bearing. This is liable to heat, if not properly lubricated. The most common form of wood pulley is that termed 'wood split pulley.'

"The usual trouble with this type is liability of looseness at the bushing. The so-called loose pulley should never be made of wood. While overheating from some of the foregoing causes is at times unavoidable, it is nearly always faulty arrangement or conditions which are directly responsible for the resulting fires. Take, for instance, machines belted to a small auxiliary or counter-shaft located on the floor; these are usually boxed in, and they form receptacles for the collection of oily sawdust; or, take lines of shafting run in trenches or low basements, not easily accessible for lubrication and cleaning. Wood pulleys also collect dust, which is seldom cleaned out. These and many others are dangerous conditions promoting fires."

Where each machine in the establishment is driven by its own motor, all shafting may be dispensed with. Where group driving is used, the shafting may be of much smaller diameters, with consequent reduction of the number and the weight of journals and hangers, with their attendant troubles.

An arrangement that has some advantages, is to locate motors and shafting in a fire-resistive basement under the machine room. That necessitates belt openings in the floor, but in a one-story building it is not very objectionable, and, where the machine room is liable to contain quantities of shavings, sawdust or other readily combustible or finely divided materials, it at least removes the motors from the immediate vicinity of the very combustible substances.

It is often well to run the main shop wiring open on ceilings and carry the branch lines to motors from the mains to starting boxes in steel conduit.

The substitution of motors for mechanical drive may be said to transfer the points of possible trouble from the belts and shafting to the wiring circuits, motors and control devices. The latter have, at least, this advantage: They usually are, when in use, under immediate observation, and failure or defect is thus less liable to escape prompt attention.

The electrical hazard may be measured by the ignorance of the person in charge of the equipment, and is also, as suggested in the foregoing, generally in inverse ratio to the size of the equipment. Installations of from twenty-five to one hundred motors are usually under the charge of a competent man, whose duty is to look after the equipment and maintain it in proper working condition. In such a mill the chances of misuse of electrical apparatus by ignorant or careless operatives are greatly lessened.

The single, small motor, tucked away in a dusty corner of a small shop, supplied by wires put in as cheaply as possible and operated by men who have absolutely no idea of the nature of the machine, is the motor which presents the greatest fire hazard, and should be viewed with the least favor by the insurance inspector or agent.

A similar distinction may be drawn between different industries. It is noteworthy that those which have utilized electric power for the greatest length of time seem to show fewer proportionate fire losses from electricity than those into which it has been introduced more recently. The printing business is an example in point. Not only do small job printers very generally have motor driven presses, but the largest presses are now made with motors attached, and the present-day press operator has perforce become as familiar with the functions of his motor and its control as with the details of his press, and it is a most encouraging sign from the insurance viewpoint.

Largely, in proportion as operatives become familiar with electric machinery, its peculiar features and inherent dangers, will the hazard from the ever extending use of motors be reduced.

In machine shops, even with the most automatic machine tools, the operator becomes to some extent an expert and learns quickly to appreciate the limitations of his motor and realizes that missue of its entails delay and consequent lessening of production. If he insists on starting his motor too quickly, he at once sees the effect in the drill or lathe and governs himself accordingly.

Flour mills and small elevators present special hazards when electrically operated, not only from the peculiar dangers of such risks, but quite as much from the comparatively unskilled laborers employed in them.

Bearings and pulleys in elevators and flour mills are exposed to exceptionally bad conditions as to collection of dust and oil, and are often placed where inspection and supervision are very difficult. Any arrangement tending to reduce the amount of necessary shafting would appear, therefore, to present special advantages in these risks. However, when the machinery is driven by individual motors, we have, in the case of direct current motors, the hazard of sparking commutators. The possibility of trouble from overheated wiring, starting boxes, switches, fuses and other electrical paraphernalia is also considerable, and it goes far to offset the possible gains from electrical power transmission in the risks.

Cotton mills also present peculiar problems, but these have been solved very largely in the years since electricity was first introduced into them. In this field alternating current motors have been notably successful, and they are peculiarly suitable, as they do not require commutators, with resulting possibility of sparking at brushes.

Woodworking shops offer special attractions for motor driving, because many of the machines are in use for short intervals only. The hazards are obvious, but they may easily be reduced by proper choice of equipment, although the average operative is probably less likely to become familiar with the details of the electric appliances. The pattern shops, connected frequently with foundries, are of course a common type of woodworking shop.

An interesting recent installation of electric drive is in the plant of the West Virginia Pulp and Paper Company, at Piedmont, West Virginia. Electric power is now used exclusively, and it replaces about thirty-five steam engines of from seventy-five to one hundred horse power that were operated independently in the plant. All of the engines, with the piping and boiler equipment, were torn out. Power is furnished from a central station, located centrally in the plant and built of concrete and steel. The provision is for 7,200-boiler horse power. The motor equipment consists of sixty-five induction motors, utilizing belt drive and direct drive and operating on a three-phase, 440-volt system of distribution. Additional equipment of induction motors, aggregating 755 horse power, has been ordered for use in an addition to the plant for making coated paper.

Packing houses are among the establishments in which it is difficult to maintain electrical wiring and apparatus in good order, because of the presence of water on floors and ceilings, the excessive heat in many parts of the establishments and the injurious effects of brine and other corrosive agents. It follows, therefore, that special pains must be taken in the electrical equipment of a packing house, and frequent expert inspection is required to maintain the apparatus in proper condition.

In steel mills the electric motor has found lately one of its most important fields of usefulness, units of very large size being employed for the operation of individual machines, such as rolls, presses and shears, and for the operation of conveying machinery. These are very often equipped with

elaborate remote control, or semi-automatic apparatus, requiring for the actual operation merely the pressing of a button by an unskilled laborer. The size and complexity of the electrical equipment, with the absolute necessity of maintenance in good operating condition, require usually the presence of an expert electrical engineer, whose services tend to reduce the probability of disaster from failure of the electrical equipment.

It may be stated in a general way that electrical apparatus may be especially hazardous from either of two quite extreme conditions. The first is the simple, cheap installation of one or two small motors, the apparent simplicity of which begets in the minds of its owners an indifference to the possible dangers. The second is an elaborate and expensive equipment, entailing many wiring circuits and utilizing to the utmost the advantages of automatic devices and remote control apparatus.

As appliances become automatic, or removed from immediate observation and control by operators, there is a disposition to rely upon the system to do the work under any and all conditions. Unskilled laborers will persist in endeavors to "make it work" under conditions which would clearly indicate trouble to a skilled electrical man, or would be evident at once in a simpler system.

In connection with this it is in order to direct attention to the presence, in electrically operated plants, of freight elevators worked by motors, often of large horse power and controlled from the car. The elevators get only scant indulgence from the men who are called upon to run them, and they may be a source of very real danger unless well supervised and safeguarded.

There are numerous classes of risks that call for special consideration from the underwriters in the event of their being electrically equipped. Many manufacturing processes involve the use of naphtha or other volatile and explosive liquids, or necessitate the storage of extra dangerous substances. The best equipment, provided electric power is to be used extensively in the risks, can be determined only by good engineering skill, supplemented by a thorough knowledge of the special hazards involved and the lessons of experience. Enclosed direct current motors, or motors of the induction type, are safest. Switches and cutouts, or fuses, should be placed in self-inclosing, fireproof cabinets, easily accessible. Electric lighting is adopted often as a consequence of the adoption of electric power transmission, introducing the special problems incident thereto, most of which are solved sufficiently in the National Code.

WIRELESS TELEGRAPHY ON THE PACIFIC COAST.

The operator in charge at Point Loma station reports having read on the evening of March 16th a message of some length, which was transmitted from the station at the Pensacola Navy Yard, Fla., and that he heard but could not read what was probably a reply from the Connecticut. This has been verified as to the Pensacola message, distance 1,768 miles, all overland, and as to hearing the Connecticut, which was at the time 100 miles to the north of Cuba.

The sailing of the Milwaukee, fitted with Shoemaker apparatus, was made the occasion of testing out the northern stations, the results of which were very gratifying, and are as follows:

Maximum distance intelligible communication was carried—distance in sea miles:

Station—	Distance.
North Head	1,130
Mare Island	760
Farallon Islands	750
Point Arguello	425
Point Loma	540
U. S. S. Charleston	600

These distances do not give the greatest range of communication possible, except in the case of North Head, as there was interruption of the test when the Milwaukee had picked up the flagship, and transmission of regular business.

The station at Table Bluff has not yet sufficient power to have taken any great part in this test, but the operator in charge reports hearing the Milwaukee distinctly until 1 a. m. of March 16th, the distance being 862 miles, and static very strong.

The contractor who has built all the naval wireless telegraph stations on the Pacific Coast, W. N. Concanon, has resumed work on the station at Cape Blanco, Ore., which was interrupted by the unusually bad weather of the past winter. It is expected that this station will be working within a month. This will complete the chain of naval stations along the Pacific Coast from Point Loma to Tatoosh Island, off Cape Flattery.

An expedition is preparing for the installation this coming summer of naval stations at Sitka and Valdez, Alaska. These stations will have greater power than any previously installed on the coast.

The success of the naval stations has been greater than was anticipated. The range of communication has increased as the skill of the operators, resulting from practice, has increased. All operators at the Pacific stations are graduates of the electrical school maintained at the navy yard, Mare Island, which has been mentioned in The Journal of Electricity.

The power of the Alaska stations will be derived from gas engines, connected by silent chain drive to alternating current dynamos.

It has been decided to do away with storage batteries at wireless stations and secure reserve power by installing duplicate gas engines, except where a local source of power can be secured, as at Table Bluff, near Eureka. Here the Fortuna Lighting Company has contracted to supply current.

The naval stations along the Pacific Coast are: Point Loma, Point Arguello, Mare Island, Yerba Buena, Farallon Islands, Table Bluff, North Head (mouth of Columbia River), Tatoosh Island and Puget Sound Navy Yard.

Mare Island and Puget Sound are in nightly communication, distance 654 miles.

The Pacific squadron at Magdalena Bay keeps in touch with Washington, through Point Loma and Point Arguello stations and is given press news by the former station nightly. The distance from Point Loma to Magdalena Bay is about 600 miles.

JAPANESE OAK TIES FOR CALIFORNIA.

Japanese oak is now being used for ties in California. It hardly seems credible that hardwood timber is so scarce and the transportation facilities so overtaxed in our Western States that oak ties can be purchased in Japan, and shipped to California to be sold there, duty paid, at a lower price than ties made from local redwood. That this is practicable is evidenced by a recent purchase of 1,500,000 Japanese oak ties for the Southern Pacific Railway and about 50,000 for an extension of the Vallejo, Benicia & Napa Valley electric road near San Francisco. These ties have now been delivered, and at a lower cost to the purchaser than soft redwood ties of smaller The timber is said to be equal to our best white oak.—Electric dimensions could have been purchased in the local market. Railway Review.

NITROGEN FROM AIR AS FERTILIZER.

The Chemical Society of Washington, one of the branches of the National Chemical Society, was addressed recently by Dr. A. Frank, Jr., of Berlin, on the uses, qualities, and methods of manufacturing calcium cyanamid or lime nitrogen, as developed by Dr. A. Frank, the father of the lecturer, and Dr. Nikodem Caro, both of Germany. The Deutsche Bank of Berlin, one of the great banks of the world, and the Siemens and Halske interests, the great electrical manufacturers of Germany, have been the financial support of the experimental and commercial efforts in connection with the production of lime nitrogen.

The subject of the address itself is of far greater importance to the world and of interest to all scientific men than its title would suggest, for it described the final accomplishment of a task which for one hundred years has been vigorously pursued by chemists and technical men, namely, the commercial production of a nitrogen fertilizer by the fixation of nitrogen from the atmosphere. The only natural deposits of nitrogen fertilizers are in Chili and these are being rapidly exhausted.

Economists, statisticians and the leading agriculturists of the various countries of the world have realized for a number of years that unless some practicable commercial means were developed of artifically producing a nitrogen fertilizer for the soil that the rapidly increasing population on the face of the earth, together with the continuous impoverishment of the soil of its necessary nitrogen contents, would bring the world face to face with starvation in a comparatively short time. The seriousness of the situation is naturally felt more keenly in the older countries of Europe where the people are more crowded upon the land and the soil has been cultivated for generations, and this fact, together with the well-known skill and patience of the German chemists, has led to a natural consequence in the final solution of the problem by German scientists.

Dr. Frank also discovered and developed the application of potash as a fertilizer and today it is one of the great industries of the world. Last year 350,000 tons of potash salts were imported into the United States from Germany.

The agricultural departments of various European governments have carried on continuous experiments with lime nitrogen as a fertilizer for various crops for the past five years. It seems that the value of a fertilizer can be determined only through a succession of yearly applications to the same fields, and it was only with the past year, or eighteen months that the exceptional value of lime nitrogen to vegetables, fruits and cereals and other crops, was thoroughly established in the minds of the government officials of the various European countries. Lime nitrogen has been produced on a commercial scale in German and Italian work for three years, and the latter works are now quadrupling their capacity, and in addition thereto, European works are in process of construction, whose initial capacity will be in the neighborhood of 50,000 tons per annum.

THE ELECTRIC FURNACE.

Few inventions have so greatly benefited the metallurgist as the electric furnace. It is not so very long ago that the highest attainable temperature by artificial means was about 2000 degrees centigrade. It is now possible, however, largely owing to the splendid researches of Siemens and others, to artificially produce temperatures far beyond this limit. We are thus able to fuse and otherwise handle in a commercial manner such hitherto refractory substances as carbon, platinum and chromium. Indeed, even the crystalline form of carbon, the diamond, which was once believed to be indestructible, can now be fused by the electric furnace. Such apparatus may be divided under two main headings, namely, those in which the heating effect is produced by the passage of the current through a resistance, which may be either a part of the furnace or may consist of the material to be treated in the furnace, or those in which the heating effect is produced by the electric arc established between two carbon or other electrodes connected with the source of current. To Sir William Siemens must be given credit for being the first to apply the electric-arc furnace to commercial operations. The British Aluminium Company utilize an electrolytic furnace for the separation of aluminium from a mixture of purified alumina and cryolite. Doctors Nernst and Glaser devised a resistance furnace which is based upon the fundamental principle of the Nernst lamp. Experience has proved that the resistance type of furnace is that most readily capable of efficient regulation. The best form of furnace seems to be that adopted at Niagara Falls, in which the heated column consists of a fused electrolyte maintained in a state of fusion by the passage of the current, and communicating its heat by diffusion and radiation to the charge which is packed round it. The measurement of the temperatures attained in electric furnaces is a very difficult matter, but by means of the thermo-couple it can be done fairly accurately. It is very difficult to estimate the extent to which electric furnaces are used, but at the end of 1900 it was estimated at 225,000 horsepower, of which about 70 per cent was employed for manufacturing calcium carbide. In the manufacture of aluminium 27,000 horsepower was used, and this figure is now greatly increased.

LAMP FIXTURES.

It is very encouraging to note the interest which architects and illuminating engineers are taking in electric light fixtures. Although it has been pointed out again and again that the design of fixtures has been left almost entirely to the fixture manufacturers, who have generally branched out into this business from that of making gas fixtures, the Electrical Review remarks that no concentrated effort has been made to overcome the objections to which this has led. It has generally been thought entirely satisfactory if a gas fixture be modified so that a lamp socket could be attached to it in place of the ordinary burner. Then some slight modifications, such as turning the lamp down, have been attempted, but no radical departure from the old ideas was made.

Along with this unfortunate condition was another: little attention was paid to directing the light produced by the lamps so as to get the desired effect. A lamp was placed in the socket, and if it did not give enough light in the direction desired, other lamps were added. Shades were frequently provided, but they were purely ornamental and useless for improving the illumination. Occasionally some very beautiful designs for electroliers have been seen, but too frequently they were merely ornamental structures which might just as well have been fitted with gas burners. In other words, little or no attempt was made to take advantage of the characteristics of the incandescent lamp other than to enclose it in an ornamental globe.

It is therefore very pleasing to find a healthy interest now being taken in these two phases of illumination. Architects and illuminating engineers are making their own designs for lighting fixtures, and are not restricted by the past history of gas lighting. And they are devoting a great deal of care to the selection of shades and reflectors which give the distribution of light desired for each room.

There is room here for the exercise of a great deal of taste and ingenuity, not only in the design of fixtures, but of shades; and there is a large and growing class interested to learn of the actual results obtained from any place where special attention has been given to the question of illumination. Data on this subject are, as yet, all too scarce.

SYNOPSIS OF ADDRESS DELIVERED BY RUFUS P. JENNINGS AT ANNUAL MEETING OF THE SOUTHERN CALIFORNIA EDITORIAL ASSOCIATION AT LOS ANGELES, APRIL 13, 1907.

In speaking in response to the allotted theme, "The Newspaper as an Agency of Promotion," Rufus P. Jennings, chairman of The California Promotion Committee, expressed his appreciation of the good work done by the press of the State, and said it had been a most valued agency for development and progress. He said in part:

"I want to express my appreciation in this public manner for the co-operation had in the work we have in hand. This co-operation has been splendid from one end of the State to the other, and it has excited fresh endeavor in all localities of the State.

"The criticism I am going to make is that some editors still seem to think that the only way to build up their localities is by disparaging other localities in California."

Mr. Jennings here read a number of clippings taken from newspapers published in San Francisco, the San Joaquin Valley, Los Angeles and other parts of the State in which invidious comparisons were made about other parts of California. He then continued:

"Does any one for a moment imagine that such articles as these do any one or any locality any good? They are intended to do harm to a part of California, and if successful in so doing can but act as a boomerang on the localities where the articles were inspired."

He then read extracts from papers speaking well of other parts of the State and pointed out how much better was this friendly way. He then read an article, most scurrilous and defamatory, that recently appeared, in "Democrat" of Madison, Wis., and said of it:

"An article such as this must have been inspired, and particularly is such a fact patent as it is similar to other articles now appearing in the Eastern press. How can such things be? How can any Californian imagine that his particular locality in California can be other than harmed by such sentiments?"

In speaking of State division he pointed out that such a division would not change the physical conditions of the country, and in this connection said:

"All the States of the Pacific Coast are linked together by close affiliations, and no matter under what names or forms of government, the interests of the entire Pacific Coast are interdependent."

In speaking of the power of the preess for good he said: "The newspapers have it in their power to change the attitude of the people of California or of those who do not yet understand the value of co-operation, by refusing to publish incorrect and unkind statements regarding any part of the State, and on the other hand to make it a point to publish news of a friendly character of other than their own localities."

He strongly advised co-operation of the press with the local organizations of the State, and said: "So I urge upon the newspapers to strongly support the local organization, and all these one hundred and seventy-five organizations centralized in The California Promotion Committee, with a membership of more than thirty thousand, with the backing of the press, make a force that is bringing continued and increased prosperity to all."

Mr. Jennings then extended an invitation to the members of the Association to attend the next semi-annual meeting of the Counties Committee of the California Promotion Committee, which will be held at Petaluma on June 7. The meeting will be devoted to the subject of "Forestry and Irrigation." He closed as follows:

"In closing I will say just a word regarding The California Promotion Committee. It is simply this: The Committee is persistently and effectively working for the entire State of California. It knows no north, no south, no east, no west. It is for the whole State—first, last and all the time. And the newspapers can be depended upon to continue to help in the work, I am sure."

LONG-DISTANCE POWER TRANSMISSION.

One of the most interesting, and at the same time one of the most important, papers read before the Institution of Electrical Engineers this session is Mr. J. S. Highfield's paper on the continuous-current series system for long-distance transmission. The system with which the name of that noted Swiss engineer, M. Thury, is associated has formed the basis of a series of far-reaching investigations by Mr. Highfield, and he concludes that M. Thury's apparatus, as improved and simplified since its first introduction in 1899, compares favorably with alternating-current apparatus, upon which so many minds have for years been at work. The problem has forced itself upon Mr. Highfield by reason of the fact that the company to which he is engineer has obtained certain powers of supply in a very large area, aggregating 300 square miles with a circumference of 80 miles, which it is desirable to supply through underground mains from a station situated on the circumference. The difficulties experienced with alternating currents, he says in his paper, can be eliminated only by the use of direct current, and he sets himself the task of examining what has already been done in this direction. One of the principal difficulties is that of resonance, which, of course, with continuous current is eliminated. The advantages and the limitations of the direct-current system are set out with fairness. After comparing the relative value of alternate and direct currents for long-distance power transmissions, Mr. Highfield indicates some of the possible directions in which the series system offers advantages over the parallel system. They are: (1) the ability to extend the possible commercial transmission distance far beyond that possible with alternating currents, and particularly in those cases where underground transmission is essential; (2) simplification of switch and regulating gear; (3) easy working of several stations in series on the same loads, so that the more efficient run always and the less efficient run only on the peak load; (4) the uniform section of the mains permits an increasing load supplied at first from one point to be readily provided for by the addition at any other suitable points on the main of other stations without addition to the cable system; (5) efficient speed regulation of sub-generators where certain special loads, such as chemical loads, are to be served from a distance; (6) greater all-round efficiency to be obtained when the generators are driven by turbine worked from a waterfall having a great percentage variation of head. In the short discussion which followed the reading of the paper, all the speakers confirmed Mr. Highfield's evidence as to the suitability of continuous current for long-distance power transmission. Professor Kapp gave some figures relating to the working of the continuous-current system in Switzerland, and a comparison between the two systems bringing 12,000 kilowatts to Zurich over a distance of 85 miles showed that, while the percentage of loss was higher in the case of alternating current than in the case of direct current, the cost of plant per kilowatt delivered was £21 for the direct current and £24 for the alternating current. The question is of importance to this country, and especially to London at the present moment. We may be a long way off from the time when the ordinary power supply stations now laid out on the alternating-current system will change over to continuous current, according to Lord Kelvin's prediction. But there is an unmistakable tendency now to go in for large supply areas, and it is in this direction that we might look for the development in this country of the system which is so successful on the continent.—The Electrical Engineer (London).

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EDITORIAL.

Testing of Electrical Machinery

The efficiency of electrical machines is the ratio between the in-put and the out-put of energy. The out-put is, for generators, electrical; for motors, mechanical. The in-put for generators is mechanical and for motors electrical. Some machines such as rotary converters or motor generator sets may have an in-put both electrical and mechanical and an out-put also a combination of both.

To determine the efficiency of electrical machines, it may be necessary to measure the electrical energy in-put or out-put and the mechanical energy in-put or out-put. Except for certain types of electrical transforming machines, it is therefore necessary ordinarily to make both electrical measurements and mechanical measurements. Though the accuracy of electrical measurements is rather higher than that attainable in other branches of engineering, notably the measurement of mechanical energy, it must be borne in mind that electrical measurements are not absolute. Direct current measurements are ordinarily more accurate than alternating current measurements and even special care is required in the measurement of either current or voltage for direct current to arrive within one-half of one per cent of the correct values. In dealing with high pressure wattmeters, either alternating current or direct current, it is quite difficult to attain results within one per cent, though the readings taken upon the instruments may be accurate within one-tenth of one per cent.

Mechanical measurements cannot be made to a degree of accuracy that is possible with electrical measurements. Taking into consideration this fact, it is quite necessary in the case of efficiency tests to allow a margin of error varying from one to two per cent, while even higher margins should be allowed in certain cases where the method of determination is indirect.

The determination of efficiency is much simplified if the efficiency of the engine or turbine and generator are not separately determined, but the unit as a whole considered. In this case, the efficiency will be obtained by indicating the engine or turbine and measuring the out-put of the generator. The simplicity of this method of determining efficiency and the importance of the result of the test from the standpoint of the purchaser has brought it into frequent use.

For the same reason it is often found that guarantees are based upon the relation of the amount of fuel required and the total energy in kilowatt-hours delivered to the switch board. The combined efficiency of the steam generating apparatus, the steam consuming machinery and the electric generators is thus determined without definitely establishing the actual efficiency of each portion of the apparatus making up the unit.

In the testing of electrical generators or motors in sizes above 300 to 500 horsepower it is usually found preferable to determine the ultimate efficiency by actual measurement of losses, rather than to measure the electric in-put or out-put and also measure the mechanical out-put or in-put. This is due primarily to the fact that the measurement of mechanical power in large units is quite difficult, due to the necessity of absorbing, more often wastefully than usefully, the entire out-put of the machine under test. In addition, as indicated above, the accuracy of mechanical measurements both by means of a brake or by indicator is much less than the accuracy of the electrical measurements. It has therefore been found desirable to avoid mechanical measurements and to determine the efficiency by measuring, usually electrically, the losses, the aggregate of which is the difference between the in-put and the out-put. It is also true that in many cases when dealing with the in-put and the out-put of electrical energy alone with such machines as static transformers, rotary converters and motor generators, more accurate results are obtained by determining losses than by comparing the in-put and the out-put. Again, the designer usually finds it necessary to calculate the losses and when the tests are made they are a check upon his method of computing the losses in the machine.

It has been found most misleading to accept as final the computed losses in electrical machinery. What are supposed to be the iron losses in machines are not in many cases the losses which occur in the unfinished

iron when the lines of force are not uniformly distributed in the iron core. There are in many cases additional losses due to varying density of the magnetic field, and in addition there are much more important losses due to hysteresis and eddy currents in other parts of the machine, whether solid or laminated. It is exceedingly difficult, if not impossible, to determine the data necessary for the computation of actual losses and rarely is it possible to obtain even approximate results by simple measurements of a test piece in the laboratory. As an illustration of this, it has been found in a number of actual tests that the so-called iron losses, including hysteresis and eddy currents, were from three to four and one-half times the losses as determined with a laboratory sample, the exact ratio depending upon the load on the machine. Therefore the most satisfactory method of making guarantees consists in basing the efficiency upon the most unfavorable values obtained from previous machines of similar construction. The actual efficiency will often be found to differ to a very considerable degree from those deduced as a result of theoretical considerations alone and which are many times the basis of the guarantees or performance specifications furnished by the manufacturer.

As a rule the purchaser of electrical machinery is only able to carry out tests upon a complete machine. On the other hand, the builder is in a position to make tests and repeated experiments during the construction not only of one machine but of a great many of the same type. The manufacturer is therefore able and should in all cases furnish guarantees which can be relied upon as representing the exact workings of the machine. Nevertheless, in determining the efficiency of large units by computation when assuming that the in-put is equal to the out-put plus the losses in the machine, the data provided by the manufacturer is found, when accurate tests are made by the purchaser, to be in many cases quite unreliable.

Electrical machinery should be judged upon other considerations than efficiency; reliability of operation as well as the maximum capacity with good regulation are both of great importance. One machine may stand an exceedingly high voltage test in the factory and break down when put in operation, due to the inferior lasting quality of the insulation used. The selection of the proper material by the manufacturer and the use of the same grade of material at all times may have as much to do with the success of a particular line of apparatus as high efficiency. The rating of electrical machinery is often indicated by the increase of temperature during a given period when operated at full normal load. The value of such a test depends largely upon the method of measuring the temperature rise. In some cases an ordinary mercury thermometer may be used. With this method it is seldom possible to measure the actual rise in temperature of the parts of the machine where most of the heat is concentrated or the actual losses take place. It is much preferable to measure the increase of temperature by measuring the increase of the resistance of the affected portions of the machine, if such a method can be used.

In general it must be admitted that laboratory or factory tests and commercial tests many times give widely varying results. This may be due to the difference in the conditions of operation when tests are made at the factory and the conditions under which machines are operated when finally installed in the plant. It is of much more importance that the commercial tests which will determine the durability, reliability, efficiency and capacity of the machine, give proper results than that the manufacturer's guarantees should be found correct immediately after the installation of the machine.

REMOVAL NOTICE.

The Electric Storage Battery Co., Philadelphia, Pa., announces the removal, on April 22, 1907, of its Pacific Coast Sales Office from No. 525 Thirteenth Street, Oakland, to temporary quarters at 11 Hawthorne Street, San Francisco. Later, notice will appear of its removal into permanent quarters now being prepared in the Crocker Building.

The operating department will be permanently located after April 1, 1907, at 11 Hawthorne Street, San Francisco.

The Pacific Coast stock of "Exide" and "Chloride" Batteries will be handled by, and may be purchased of the Exide Battery Depots, Incorporated, which will be permanently located at 11 Hawthorne Street after April 1, 1907.

R. B. DAGGETT,
Manager San Francisco Office.

PERSONALS.

H. B. Vanzwoll, secretary of the Sunbeam Incandescent Lamp Co., visited San Francisco very recently.

Mr. J. Frank Adams, general manager of the Southern Nevada Consolidated Telephone and Telegraph Company, has been in San Francisco during the past week.

Mr. A. N. Palmer, representing the Phillips Insulated Wire & Cable Co., and Mr. N. C. Brenner, proprietor of the American Insulated Wire & Cable Co., have recently paid a visit to the Coast in the interests of their respective companies.

A. L. Salt, general purchasing agent of the Western Electric Co., with headquarters in New York City, is visiting the Coast in the interest of this company, of which the California Electrical Works is the main western branch.

Mr. M. A. Farnsworth announces the severance of his connection as president and general manager of the Farnsworth Electrical Works, and Mr. Farnsworth has now established on his own account the M. A. Farnsworth Electrical Machinery and Manufacturing Works, at 16-18 Natoma Street, near First. In addition to the sale and rental departments containing a full line of new and second hand motors, transformers, dynamos and centrifugal pumps, a general repair establishment, thoroughly equipped with the most modern and improved machinery, has been installed, giving unsurpassed facilities for prompt and efficient service.

Mr. Fred R. Jenkins, representing the H. Krantz Manufacturing Company, has been in San Francisco for some time

looking for a desirable location. The Krantz Company's panel boards, switchboards, etc., are well known in Chicago and New York and no doubt are known to many of San Francisco's builders and architects. Among other well known installations, their apparatus has been used in the St. Regis Hotel, Hotel Astor, Hotel Belmont, Metropolitan Life building, and Wannamaker building, in New York; Marshall Field building, Mandel Brothers, Chicago Savings Bank, in Chicago; Bellevue-Stratford Hotel of Philadelphia, and many others.

ANNOUNCEMENT.

The Wagner Elec. Mfg. Co. of St. Louis desire to announce the appointment of Mr. F. Johnson, district manager of St. Louis territory.

Mr. Johnson has been connected with the sales organizations of the General Incandescent Arc Light Co., Stanley G. I. Co., and later with the General Elec. Co., having been located in St. Louis, representing these companies for the past eight years.

The completion of the new works of the Wagner Elec. Mfg. Co. in the outskirts, has made necessary the opening of a St. Louis district sales office, and this office will be located in the Frisco Building, Mr. Johnson or his assistants being available at all times for consultation on matters pertaining to the sales in the St. Louis territory.

TRADE CATALOGUES.

Woodin & Little have published a new catalogue (number 33) covering the specialties that they carry. These comprise pumps, windmills, tanks, gasoline engines, pipe fittings, etc. This issue supersedes all former catalogues and the company request that all old ones be destroyed. Those desiring copies address the firm, at 534-536 Mission street, San Francisco.

The Allis-Chalmers Company have issued a new corrected index, showing catalogues, bulletins, instruction books, etc., in force April 1st. This gives a list of one hundred and thirty-five (135) publications, each treating of a separate product or group of products of Allis-Chalmers Company. Among these are comprised their new line of bulletins, eighty-eight (88) in number. It will be observed that in addition to the numerical arrangement, they have the publications classified according to subject. This makes the index convenient for reference, and the feature is one which they intend to extend much farther in a subsequent edition.

CALIFORNIA PETROLEUM.

For a number of years California petroleum has shown an increasing output, and this increase will be marked in the statistics for 1906. A greater demand was created during the closing months of the year than at any previous time. This was doubtless due to the large contracts entered into with Japan, and the completion of the pipe line across the Isthmus of Panama, through which petroleum will be piped and supplied to the Atlantic Coast. Shipments are now being made to the Pacific terminal. The outlook for better prices is evident in the exceptional demand. A large amount of new territory is being prospected, and many new wells are being sunk in the proved districts. Owing to the low prices that formerly prevailed, and also to overproduction, comparatively little prospecting had been done for some time, and many strong producing wells were capped, but now all of this is changed, and every effort is being put forth to supply the present demand.—From "Mines and Minerals."

WORLD'S TRADES UNIONS.

The United States Labor Department publishes some interesting figures showing the number of members of trade unions in various countries. The following table gives a summary of what is shown in the report. The figures relate to 1905, except in the case of Australia, Italy, Holland and Norway, which refer to 1904.

	Members of Trade Unions.	Per cent of Population.
United States	circa. 2,000,000	2.64
Great Britain and Ireland	1,866,755	4.50
Germany	1,822,343	3.23
France	781,344	2.00
Austria	323,099	1.24
Italy	260,102	0.80
Belgium	128,700	1.92
Sweden	105,500	1.92
Australia	100,626	2.66
Denmark	90,911	3.71
Hungary	71,173	0.37
Spain	56,905	0.31
Switzerland	48,000	1.44
Holland	37,221	0.73
New Zealand	27,714	3.58
Norway	16,227	0.73

The membership of unions in the United States can only be stated approximately, as many organizations publish no figures at all and others publish unreliable ones. The American Federation is the largest Federation in the United States; at the end of 1905 it had 1,494,300 members. In addition to this body there are the seven railroad brotherhoods whose aggregate membership is 250,000, and a number of other smaller unions not belonging to the American Federation of Labor. From this table it appears that although the countries stand in the order shown as regards the total number of organized workers, yet, in proportion to the population, the United Kingdom has the largest number of trade unionists; Denmark coming second, New Zealand third, Germany fourth, while Hungary and Spain come last in the list with 0.37 per cent and 0.31 per cent respectively. Great Britain, which has a population only slightly greater than France, has more than twice as many members, and Australia and Denmark, both countries with small populations, have more organized workers than Hungary or Spain. On the whole, the Latin countries are far behind the Anglo-Saxon and Teutonic.

The Pacific States Telephone Company is to absorb the Nez Perce Co-operative Telephone Company, operating in Idaho, south of Spokane. The two organizations are rivals in the territory. It is understood that the $15,000 worth of new stock which the Nez Perce company is to issue in the near future is to be taken over by the Pacific States Company, which will give the latter the controlling interest in the farmers' line. The capitalization of the Nez Perce company is $10,000, and at a recent meeting of the stockholders it was voted to increase it to $25,000, the proceeds from the sale of the stock to be used for the improvement and extension of the company's plant and lines.

INDUSTRIAL

THE LAZIER GAS ENGINE.

A Miracle of Simplicity, Efficiency and Economy.

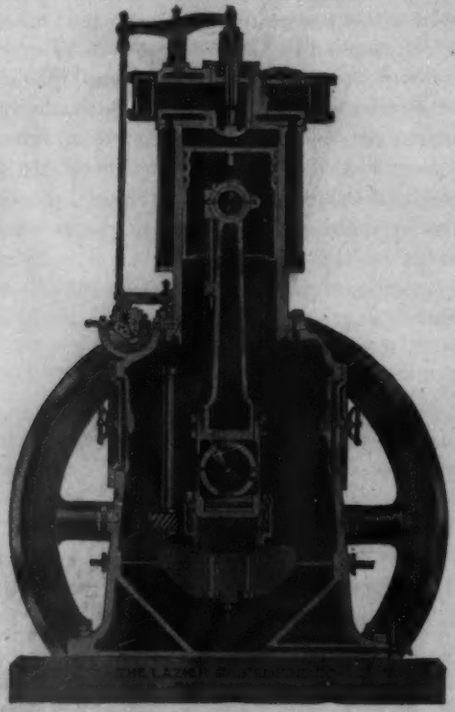
The evolution of power, from the primitive steam engine, crude and imperfect, but containing the principle which made possible the monsters of iron and steel, which have revolutionized the world, to the new mechanical marvel, the gas or air expansion engine, includes the history of all modern progress and all modern civilization.

With the steam engine, wonders were done—with the gas engine miracles have happened. With its aid, navigation of the air is an accomplished fact—automobiles skim the earth at a speed deemed, a few years ago, unattainable—submarine boats dive into the depths of the seas, like ducks—and power, which has multiplied a millionfold the productive capacity of human hands, has been placed within reach of even the farmer, to aid the bounty of Nature.

The principle of the gas, or air expansion engine was from the first accepted as a new and most important discovery in power development, which would eventually supersede steam, and since that time, the efforts of mechanical engineers have been directed to simplifying the engines into which this mighty power has been harnessed.

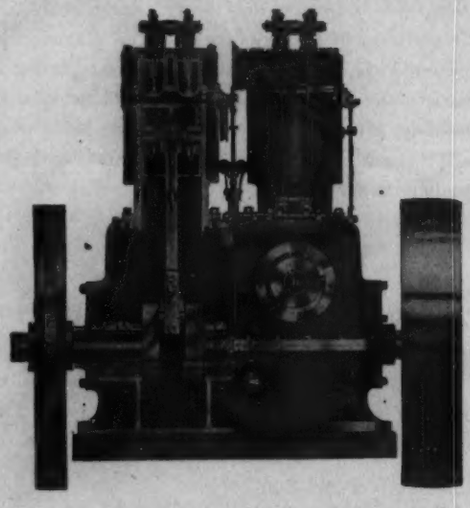
As no class of business men is more vitally interested in the question of economical power than the readers of this Journal, we believe a short description of the very latest type of gas engine, which has just been placed on the market by the Lazier Gas Engine Company of Buffalo, N. Y., will be of interest to them.

Mr. Arthur A. Lazier, one of the pioneers of gas engine



development, has been engaged for several years in the perfecting of a type of gas engine which would eliminate the objectionable features of the engine formerly in the market. Having at last succeeded, he recently disposed of his entire interest in the Lazier Engine Manufacturing Company and organized the Lazier Gas Engine Company, to enter upon the manufacture of what appears to be the perfect gas engine. He has associated with him in the company a staff of mechanical engineers, which includes some of the best known gas engine experts in the United States. Two large plants are now in operation, producing the Lazier gas engine.

In principle like other gas engines, the Lazier engine differs from all other engines in the simplicity of its construction, the almost utter impossibility of its getting out of order, and the fact that all the mechanism of the machine, instead of being on the inside of the engine, is on the outside, where inspection and repairs can be made without tak-



ing the entire engine to pieces.

In this engine the valves are operated mechanically, so that they cannot get out of order.

Ignition is of vital importance in a gas engine. In every other type of gas engine, if the igniter should fail to work or fire the gas, the engine comes to a stop and remains at a stop until repairs have been made. In the Lazier, a double system of ignition, which can be run either separately or in combination, has been provided, and is so arranged that the time of firing the charge can be changed while the machine is in operation.

Another new and striking feature of the Lazier is that the cams and cam shaft run in oil, but are still in plain sight of the operator at all times. The system of operating this cam shaft is also new, there being but four gears to the entire machine, and these being spiral gears and running in oil, make the operating almost noiseless. The usual objection to a vertical engine has been in the lack of a suitable method of taking up the lost motion in the connecting rod. In the Lazier, this is eliminated by the extended take-up, as shown in the cross section, end view cut. In fact, provision has been made throughout the entire machine for taking up the lost motion of all working parts.

The "splash" system of lubrication, which oils the engine automatically, is used and all Lazier engines are provided wih automatic self starters, enabling the operator to start the engine two minutes after stepping into the gas room.

One of the main features of special importance to the buyer is that the Lazier engine operates on almost any kind of fuel—alcohol, kerosene, distillate, illuminating gas or producer gas. The producer gas, which is made from ordinary hard or soft coal, is available in any part of the country.

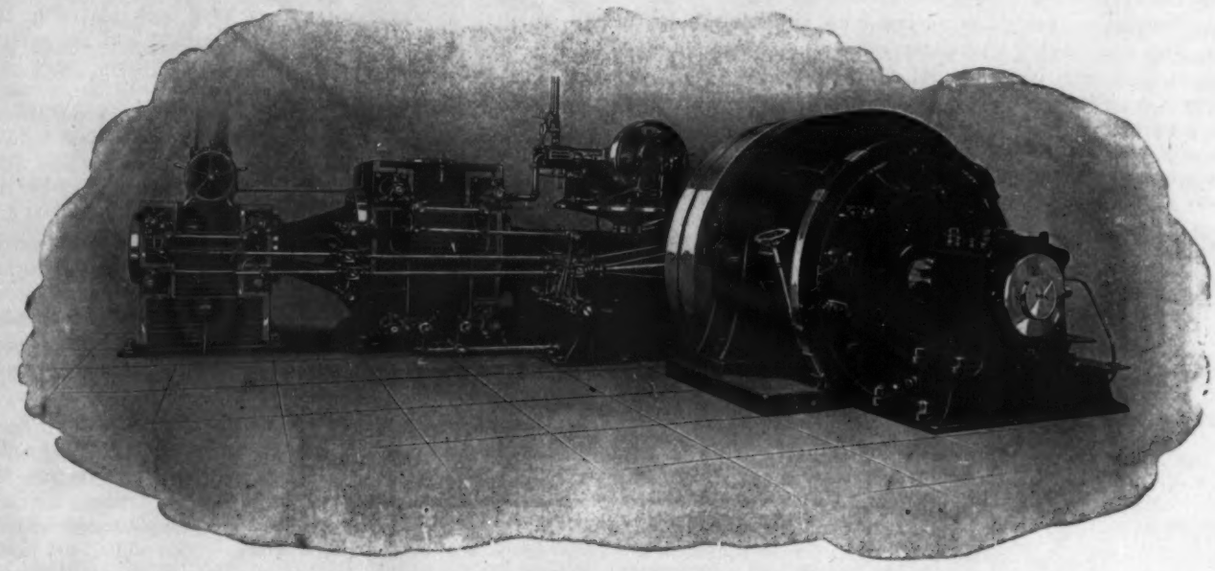
With coal at $3 a ton a horsepower is produced for $4 per year, running constantly for ten hours a day, and the economy of operation over a steam plant of equal power will pay for the entire equipment in from eight to eighteen months.

The Lazier is made in all sizes from 2 to 300 horsepower, and the simplicity of its construction has enabled its manufacturers to place a machine far superior to any other type of gas engine on the market at prices much lower than any reliable machine has ever yet been sold.

FLEMING ENGINES.

About thirty years ago the Harrisburg Foundry and Machine Works of Harrisburg, Pa., began the manufacture of steam engines, and a steady progress in steam-engine design, together with the careful selection of materials and the employment of skilled workmen, resulted in such an extensive demand for the products of these works that it was necessary to rebuild them completely in 1900. The new works are distinctly modern in the character of their equipment, and their location in the heart of the great coal and iron state gives them superior advantages for securing raw materials.

The goal aimed at in the construction of Fleming engines has not been to produce prime movers of a low first cost, but, what is more important to the investor, engines characterized by reliability, high efficiency and long life, with



but small outlays for repairs under exacting service. Special attention has been given to the subject of renewals. A complete system of interchangeable gauges for interchangeable parts, a full record of other parts from micrometer measurements, and a comprehensive system of pattern numbers insures a prompt response to orders for broken or worn out parts.

The Fleming engines of to-day differ from the Fleming engines of a few years ago, particularly in the disposition of the crank. A few years ago the engines were built entirely in accordance with the accepted centre-crank type of construction, but about 98 per cent. of the engines built at the present time are of the side-crank, two-bearing type. Some of the advantages of this kind of construction are the correct maintenance of perfect shaft alignment, the equal distribution of the pull on the two bearings of a belted unit, greater accessibility, small friction loss and economy in manufacture.

Another feature of Fleming engines is the self-lubricating, or "splash" system of oiling. By means of an ingenious and simple construction a considerable saving in oil is accomplished by freeing it from condensed water dripping from the piston rod.

The governor used is of the centrally balanced, centrifugal, inertia type. A fixed speed may be readily changed by adjusting the weights in the pockets provided at the ends of the governor arms, while small variations in speed may be obtained by changing the spring tension—a greater tension increases the speed. On the larger units, especially those used for driving alternating current generators, additional speed changing devices are supplied when so desired. These are operated either by electrical or mechanical means, or by both.

In the Fleming single-valve engines balanced piston valves operating in removable bushings, or cages, are used. Both valves and cages are made of close-grained, hard iron chilled in casting, which lends itself to accurate surface grinding and permits of a perfect steam tight fit.

The types of engines built by the Harrisburg Foundry and Machine Works are the Fleming simple, tandem and cross-compound single-valve engines, the Fleming simple, tandem and cross-compound four-valve Corliss engines, and the long-stroke Corliss engine. These are built in about nine hundred different styles and sizes for capacities ranging from 6 to 3,000 horsepower. That the Fleming, or Harrisburg engines are looked upon with great favor, especially on the Pacific Coast, will be readily seen from the following contracts recently placed with Charles C. Moore & Co., San Francisco, who are the Pacific Coast agents:

A 300-kilowatt complete power plant for the city of Pasadena, to consist of Babcock and Wilcox boilers, Fleming four-valve engines, and a complete condensing equipment.

Two 200-kilowatt Fleming four-valve engines for the Fairmont Hotel, San Francisco.

One 100-kilowatt Fleming four-valve engine for the Merchants Exchange building, San Francisco.

A complete 250-kilowatt electric plant for Taylor & Co., Oakland. The contract calls for Fleming four-valve condensing engines.

A 200-kilowatt Fleming engine for the Globe Grain and Milling Company, San Francisco.

Among the other contracts recently accepted by Charles C. Moore & Co. are the following:

A 1,500-kilowatt Curtis turbine for the American River Electric Company, together with the boilers, heaters, piping, erection, etc.

Two Ideal self-oiling engines for the American Biscuit Company, in addition to a Cochrane feed-water heater and purifier.

CHRISTENSEN PORTABLE AIR COMPRESSORS.

One of the most noteworthy developments in the history of mechanical progress, during the past few years has been the constantly increasing use of compressed air for a great variety of industrial purposes. Pneumatic tools and other appliances for the utilization of this product have been gradually introduced into one field after another, with such satisfactory results that the benefits to be derived from the use of compressed air, for operations covering a wide range of service, are now fully recognized.

In many cases it is also found advantageous to use an air-compressor which, with its various accessories, can be brought directly to the work, instead of having its product transmitted from a distance.

The best known and most serviceable machine of this type is the Christensen portable air compressor, now manufactured solely by Allis-Chalmers Company, the simplest form of which may be seen in the accompanying illustration. Many thousands of these compressors are in service throughout the United States, as well as abroad.

The equipment consists of the following parts:

1—Motor-driven Compressor.
2—Automatic Governor.
3—Switch and Fuse.
4—Reservoir.
5—Air Gauge.
6—Connection Pipe, Hose and Fittings.

The entire apparatus is mounted on an ordinary four wheel platform truck. The compressor is designed in the most compact form possible. Its connecting rods are operated by a drop forged steel crank shaft, set at such an angle as to give the best balance to moving parts. The crank shaft is extended at one end to receive a double helical gear, which meshes with the pinion of armature shaft directly above. The gear is cut with two keyways, which are placed at 90 degrees apart, so that when the teeth of the gear are worn on the sides, corresponding to the greatest pressure on the piston, the gear may be shifted at a corresponding angle on its crank shaft to present another set of teeth, thereby keeping the wear even. The motor base forms a cover for the compressor, and a suitable casing is provided for the gear. The compressor base is filled with oil at the filling elbow provided for that purpose, and all of the working parts operate in a bath of oil.

The motor for operating this compressor is of the series type (started and stopped without resistance of any kind) the coils of which are form wound and thoroughly insulated. It is very carefully built, both mechanically and electrically, and so constructed that the armature and fields can be removed, if necessary, without disturbing any other parts of the machine.

The automatic governor is so designed as to start and stop the motor compressor at minimum and maximum pressures, respectively. The mechanism of this governor consists of an ordinary pressure gauge which is actuated by the compressed air in the main reservoir. When the maximum pressure is reached, a contact is formed by means of this mechanism in such a way that the motor circuit is open, and upon lowering the pressure to the minimum point the circuit is closed, a magnetic blowout coil being provided for extinguishing the arc and preventing the burning of the contacts. All of these parts are accessible for inspection and repairs.

The reservoir is of seamless cold drawn steel, made in one piece, with the bottom pressed in and the end of the reservoir shell beaded over to form a joint, which is afterwards made solid and tight by brazing and tinning. These reservoirs are tested at 300 lbs. hydraulic pressure.

These compressors are furnished for capacities of 11, 16, 20, 50 cubic feet of free air per minute. Each is constructed throughout with sufficient strength to withstand a working pressure of 100 lbs. per square inch. The motors are designed for all standard voltages, as required.

A NEW HIGH PRESSURE INSULATOR.

Press dispatches state that Mr. Fred M. Locke, the pioneer in the manufacture of porcelain insulators for high pressure work, has after long experiment produced a new wonder in the insulator line which is exciting the most lively interest of high pressure electrical engineers. Under the most favorable circumstances, heretofore, it has been only with difficulty and danger that electric current with from 40,000 to 60,000 volts pressure has been transmitted; and even then insulation has been so imperfect as to cripple the service.

The new insulator produced by Mr. Locke permits the transmission of electric current up to any voltage desired. He claims that the range of insulation is unlimited, both electrically and mechanically.

Experts predict that the new Locke insulator will supersede all others on transmission lines where high pressure is desired. It is much less expensive than the insulators used at present.

ELECTRICALLY-DRIVEN PAPER MILL IN JAPAN.

Representatives of the Oji Paper Company of Tokio, Japan, have for some time been inspecting various electrical properties in the United States with an eye to installing a modern electrically equipped paper mill in Japan. As a result of their investigations, orders have been placed in the United States for a very complete electrical and mechanical equipment amounting to over a million of dollars.

The new Japanese paper mills, which will be operated by the electric drive, will include in addition to the motor equipment of the paper making machinery, a new hydro-electric plant, with a fifteen mile transmission line and sub-station. The electrical equipment will be furnished by the General Electric Company.

At the power station there will be installed four water wheel driven three-phase 3125 K. V. A. units, generating current at a potential of 3,450 volts, at a frequency of 60 cycles. Current for exciting the revolving fields of these generators will be furnished by the usual twin exciting units, consisting of two 150 kilowatt generators, driven respectively by an induction motor and a small water wheel. Generator regulation will be effected by a Tirrill regulator.

Twelve water-cooled, step-up transformers will be arranged in sets of three to raise the generator voltage for transmission. Each transformer will have a capacity of 1,050 kilowatts and the primary voltages will be arranged with Y connections for either 46,000 volts, 45,000 volts, or 44,000 volts. An eight-panel switchboard embodying the standard practice of the General Electric Company will be installed in the main station.

At the sub-station near the mill, twelve step-down transformers will be employed to reduce the transmitting potential to 2,200 or 2,100 volts. The switchboard will be arranged to distribute power at the desired voltage directly to the motors.

In the paper mill five 750 horsepower, 2,000 volt induction motors will be used to drive the pulp grinders. These motors are known as Form M, having an external resistance in the armature circuit and controllers to vary the speed. Each motor will have an extended shaft and will be so placed between two pulp grinders that both grinders can be driven directly without belting.

Four beater machines are to be driven, each by a 350 horsepower induction motor operating at a potential of 2,000 volts. A fifth will be driven by a 200 horsepower induction motor and all will be operated on the rope drive system.

The Oji paper mill will be situated at Hokaido on the seashore facing the Pacific. It will be an excellent example of modern engineering practice of which there are coming to be so many typical installations in Japan.

NEWS NOTES

TELEPHONES AND TELEGRAPHS.

New Westminster, B. C.—Hines & Austin contemplate the construction of a telephone line from Coquitlam to this city.

Marshfield, Ore.—The P. S. Telephone Company will erect a new exchange building at corner of C and Second streets.

Seattle, Wash.—The Pacific Coast Steamship Company is to equip all its boats running between this place and San Francisco with wireless apparatus.

Missoula, Mont.—The People's Telephone Company, capital $10,000, has been incorporated by F. M. Taylor, R. D. Prescott, J. A. Moss and W. R. Hamilton.

Waterville, Wash.—A new independent telephone line is to be constructed from Douglas ten miles east. Connections will be made into this place. George Ellis, promoter.

Salt Lake, Utah.—Adolph H. May, for the last three years manager of the Western Union Telegraph office, has just been made superintendent of the Pacific division, with headquarters in San Francisco.

Seattle, Wash.—Preparations of the United States government for a wireless telegraph station on Pier B are nearly completed and within a few days a station on the west end of Pier B will be commenced.

Farmington, Mont.—The Farmington Co-operative Telephone Company has been incorporated with a capital of $6,000 by H. R. Thompson, R. H. Wright and Ben Bollerud. The company will build lines to Chateau, Collins and Conrad.

Livingston, Mont.—The Shields River Telephone Company is planning to construct branch lines from Clyde Park to Cottonwood and Horse Creek and establish a toll line from Myersburg to this place. Forty miles of new line will be added to the company's system.

Sacramento, Cal.—Negotiations have been concluded for the absorption of the Capital Telephone and Telegraph Company of this city by the Pacific States Telegraph and Telephone Company. The former was established in 1895 for the purpose of opposing excessive charges by the Sunset Company. Long distance lines were extended to Folsom, Galt, Auburn, Placerville and most of the small towns in the counties near here.

Oakland, Cal.—Under a revision of the system of the Pacific States Telephone and Telegraph Company the Oakland division will include, besides Alameda and Contra Costa Counties, Del Norte south of Crescent City, Humboldt, Mendocino, Lake, Sonoma, Napa, Solano, Marin and Sacramento Counties. The new division will be in charge of John Kearns, one of the most experienced telephone men on the Coast. He was formerly in charge of the interests of the company in Sacramento and Coast divisions. Peter J. Lynch, division manager of the company, with headquarters in Oakland, has been promoted to the position of assistant general superintendent, with offices in San Francisco.

San Francisco, Cal.—Regarding a possible strike of the telephone operators, W. J. Phillips, division manager of the Pacific States Company, says: "There will be no strike of the telephone operators in our employ unless they bring it on themselves. We have our own reasons for opposing a union of operators, but we have been using no threats against the girls who belong to the new organization. Considerable misinformation has been circulated since the girls have shown a disposition to unionize. In the first place, the company has not been contemplating a reduction in wages. Quite the contrary, it has been for the past few weeks drafting a new scale, which will go into effect soon and materially raise the wages of operators. It was in course of preparation before the girls talked of unionizing. As for the recesses of the operators, they have not been abandoned. The company believes that lienency toward its employees pays, and it is its policy to cultivate it."

SPOKANE, WASHINGTON.

The Interstate Telephone System plans to expend $30,000 in improvements in Coeur d'Alene, Idaho, 34 miles east of Spokane. The Interstate begins with 500 subscribers. Fifty men are employed making the improvements. The harmonic system will be installed. There will be no cut in prices.

A telephone line has been constructed by the farmers along Bear Ridge, with centrals at Kendrick, Idaho, south of Spokane. There the line connects with the Interstate Co-operative line, which has connections all over Northern Idaho. Four farmers' lines are to be built into Kendrick this summer, and this will make that town the central for nine farmers' lines.

The rural telephone line known as the Barbee-Fletcher line, at Pullman, Wash., south of Spokane, recently sold to S. H. Breeze, has been consolidated with the Burgan-Hungate line. The lines will be known as the Breeze-Burgan Teiephone System, and many new telephones will be added. This line accommodated a large district, giving the farmers connection with Pullman, through the Farmers' Telephone Office, with Colfax, Albion and more than 200 farmers' homes.

Spokane, Wash.—Stockholders of the Waitsburg Rural Telephone Company have granted a 10-year lease of the system to the Pacific States Telephone Company, which has been working two years to get control. The system comprises 21 lines and 200 instruments. According to the lease the contract can be terminated at the end of a year if the service is not satisfactory. The Pacific States Company is to keep the system in repair and charge the Rural stockholders at a fee of 25 cents a month. Lodges, halls, city halls and the school buildings have been donated a share of stock by the Rural company.

Spokane, Wash.—Officers of the Home Telephone Company announce that the new Spokane concern has no connection with the Home companies of California, except by long distance arrangement. In Spokane and in the State of Washington, the Home company is a separate organization from the California concerns, they say. For the State of Washington the Empire Electric Company has been formed to construct the lines of the Home company. Robert Tucker is president of the electric company. It is claimed the entire electric company was organized in this State for the purpose of avoiding labor troubles, and that there is no other object in the organization.

Spokane, Wash.—After three years' losing fight with the Independent concern at Wenatchee, Wash., west of Spokane, the Pacific Telephone and Telegraph Company has met the Farmers' Telephone Company with a flag of truce, making an offer which may result in consolidation. The proposition by the Bell people is to turn over all local business of the territory within certain prescribed limits to the Farmers' Telephone Company for ten years, and the Farmers' company is to take the long distance business on a commission. The boundaries embrace all of Kittitas County within a radius of 15 miles of the town of Wenatchee and all of Chelan County, east of a line drawn north and south, through a point two miles west of Peshastin and a line drawn

parallel to the six miles north of Wenatchee River. Z. A. Lanham is president and H. C. Littlefield is secretary of the Independent company.

Spokane, Wash.—The Pacific Telephone & Telegraph Company and the Farmers' Company, of Wenatchee, Wash., west of Spokane, have come to an agreement, after a conference by G. B. Bush, of San Francisco, and F. R. Bingham, of Spokane, with officials of the last named concern. Under the provisions of the understanding the Pacific company is to turn over its local and long distance business at once, and the two systems will be combined as soon as the change can be made, and not later than May 1. A three-section, multiple, common battery switchboard will be installed, and a new long distance section will be put in. The Pacific company agrees to remain out of the local field for ten years. The Farmers' company has completed its line to Peshastin, and is now constructing a line from the Dunkard settlement to Monitor. The company was incorporated in 1903. Z. A. Lanham is president and H. C. Littlefield is secretary.

Spokane, Wash.—F. C. MacGougan, manager of the Pacific Telephone & Telegraph Company, announces that from $500,000 to $750,000 will be expended in Spokane in the betterment of the service. The company has under consideration the erection of a new exchange building to be fitted with a class B switchboard, while another plan is to erect one or two branch exchanges to be operated in connection with the present plant.

Every telephone in Spokane will be exchanged, a new instrument of the latest model being installed in place of those now in use. That this may be accomplished a great deal of inside wiring is necessary, and this is being attended to by a staff of forty men. Under the new system the batteries now in use at the telephone stations will be thrown out, and in their stead the required energy will be supplied by big storage batteries in the central office. This will prevent trouble with telephones due to defective batteries.

When the improvements are completed 95 per cent of the Bell telephone wires in Spokane will be in cables, either underground or overhead. There are on hand for this work 88 miles of aerial cable, so that no delay is anticipated. Twenty-two miles of underground cable and 30 miles of aerial cable are now in use. Where underground work is done the block system is used, the telephone in one block reaching the conduit via a single pole, which is placed generally in the center of the block. Putting the plant on an all-cable basis will cost several hundred thousand dollars.

Mr. MacGougan made this official announcement:

"The company is making preparations to provide service which shall be adequate for a city several times the size of Spokane, now with 100,000 inhabitants. The officials in San Francisco are watching closely the growth of the cities on the Pacific Coast, and have been most favorably impressed with the progress Spokane has made in the last few years, and with its prospects for future growth. In the telephone building, erected seven years ago, and enlarged four years later, and which may have to be still further enlarged, thirty-five electricians have been working since last July, changing the distributing frame to new standard model. It is expected that this work will be completed in two months.

"Every bit of old equipment in the exchange is being replaced with an outfit of the latest model. The switchboard, a local battery express board, is being changed to common battery multiple. The work should be completed by the time the distributing frame is remodeled. The advantage of the No. 1 common battery board is that it makes possible quicker service, with fewer mistakes. With the new board every subscriber may be reached at any time by every operator. The board has a capacity for 9,600 lines, but can attend to more than 11,000 subscribers, since several may have telephones on one line. The 9,600 'jacks' which are used in making connections, are repeated at intervals of a little more than five feet, and each operator can reach every one of them.

"When the improvements in the switchboard now in progress are completed the enlarged capacity will be required to attend the business now in sight. It will be necessary to make immediate preparation for enlargement, and the engineers are considering which method will be most advisable. The new switchboard is being equipped to its fullest capacity and there will require 46 operators in addition to 150 now employed. The addition of a board will provide immediate accommodation for 5,000 additional lines. The new toll board, provided for in the engineers' estimates, is necessary to attend to constantly increasing long-distance business."

TRANSMISSION.

Los Angeles, Cal.—The Pacific Light and Power Company has petitioned for a franchise to put up poles and wires along every public road in the county except those in incorporated cities.

Oakland, Cal.—A special dispatch from New York states that one of the directors of the Western Power Company gives out that his company will erect a steam plant in San Francisco or Oakland. Between $2,000,000 and $3,000,000 are involved in the deal.

Redding, Cal.—A party of Portuguese laborers has arrived at Manton to work on the large reservoir of the Northern California Power Company at Macomber Flat. Water is to be carried to this reservoir from Manzanita Lake, near Mt. Lassen. A telephone is to be strung from Manton to Macomber Flat.

Santa Cruz, Cal.—Mr. Sterling has charge of the erection of the new powerhouse at the beach, for which the pile driving has already begun. Only sufficient machinery will be installed at the outset for the development of 900 horsepower, but it will be possible later to increase the output to 4,000 horsepower. The plant is expected to be running within a month.

Johnnie, Nev.—A big move in mines, railroads, timber and farming lands is under way in this vicinity. The Brock-Miller interests, owning the Tonopah and Goldfield Railroad, are expected to continue their line south through Johnnie to Tecopah, Cal., some sixty miles south of Johnnie. In this connection there will be launched, according to latest reports, a big agricultural, mining and power enterprise. By utilizing the water obtainable, it is expected that electricity will be generated sufficient for mining and lighting and the operation of the railroad.

Chico, Cal.—William H. Bissell, purchasing agent for the Great Western Power Company, states that on account of the storm and the loss of the Oroville bridge, his company would change its headquarters to either Durham, Thermalito or Chico. The base for forwarding supplies will be Durham and everything will be hauled by wagon from there. The damage at Big Bend was not so heavy as first reported.

The National Brake & Electric Company of Milwaukee, Wis., reports that as a result of the passing of the recent traction ordinance in Chicago, the Chicago City Railway has given instructions to proceed at once with the filling of an order for three hundred of the new National air brake equipments, which had been placed some time ago. This is one of the largest recent orders for air brake equipments for electric cars placed, and brings the total number of National equipments, in service on the Chicago City Railway, to the imposing total of nearly one thousand.

TRANSPORTATION.

Portland, Ore.—Negotiations are in progress for the establishment of a car building plant here. The site of the proposed works has not been fully determined. Walter H. Judson, Portland agent for the Evans Railway Equipment Company, is at the head of the corporation. A number of Portland capitalists are interested with Mr. Judson, and a fund of $500,000 has been raised to effect the organization.

Sacramento, Cal.—After many months of delays through the action of the storms and floods, the Northern Electric Railway Company, which is building a network of interurban lines throughout Sacramento Valley to center here, has commenced tracklaying within the city. Great activity is reported from the construction camps along American River, and when summer is fairly opened Sacramento will have been connected by trolley with all the important cities and towns in this valley.

Santa Cruz, Cal.—Two more condemnation suits have been filed by H. A. V. Torchiana, attorney for the Union Traction Company, with the county clerk for a double track right-of-way through the lands of Lucy Salomonson and Lucy Winkle, who own adjoining properties near Rodeo Gulch. A section in each of the complaints outlines the route to be followed by the extensions which will be added to the electric system of this city. It is proposed to extend the Capitola line from Capitola to Soquel to Santa Cruz.

Long Beach, Cal.—The Pacific Electric line is to build a branch line from the proposed Wilmington electric road from the intersection of Water street and the continuation of Twelfth Place to the end of St. James Place, at Knoll Park. It will connect there with the proposed Daisy avenue extension, which will be built around Knoll Park on the Lome Vista drive, and thence around the bluff down Ocean Park avenue, connecting with the main West Long Beach line at the corner of Ocean Park and West Ocean avenues.

Mill Valley, Cal.—Owners of the Mt. Tamalpais Railroad have about completed a new branch line for their mountain system. It starts from the main line at the famous double bow-knot and in a distance of five miles drops 1,000 feet near the edge of a redwood forest covering 600 acres. At the end of the road cottages and a hotel are to be erected 600 feet above sea level. It is the intention to connect the hotel and forest by an incline railroad. It is expected that all these improvements will be completed by July 1st. Trains are to be run direct from San Francisco to the forest in connection with the ferry system of the Northwestern Pacific road via Sausalito and Mill Valley.

Berkeley, Cal.—Application will soon be made by the Key Route for the privilege of laying another double track road. Having just been favored with one permit to double track Claremont avenue, they will again ask the trustees for a franchise from Fortieth street along Sacramento to Hopkins street. Sacramento will be widened to 110 feet and made a great thoroughfare through that part of Berkeley, as Adeline is further eastward. The Key Route and Harold Havens own the entire east side of Sacramento street from Fortieth to Hopkins and the widening of the street will be off their property and not affect any of the private owners. There will be a station built at Ashby, Dwight Way, University and Hopkins street. It is the intention of the Key Route to run 40-minute trains at first. As soon as the traffic will warrant it, they will put on a 20-minute service from Fortieth to Hopkins. Havens will soon put his property on the market, and that near the proposed stations will be first offered for sale. The new Key Route line will place this district in direct communication with San Francisco and will be an active competitor with the Southern Pacific lines.

ILLUMINATION.

Alameda, Cal.—Bids have been advertised for by the Board of Trustees for a water tube boiler, together with certain steam pipe work for the municipal electric light plant.

Wallace, Idaho—The Horn Silver Mining Co., which owns a group of claims on Placer Creek, is considering the installation of a mill.

Newport Beach, Cal.—According to the plans of Horace Slater this place is to have a gas plant by the first of June. The promoter is a citizen of Redlands.

Los Angeles, Cal.—Officers of the Los Angeles Gas Company have taken out a permit for alterations to the company's plant at No. 552 South Alameda street. The cost of the improvements will be $40,000. Parkinson and Bergstrom are the architects.

Los Angeles, Cal.—Property owners on Twenty-eighth street between Figueroa and Hoover, have petitioned that boulevard lights be placed at each alternate space of one hundred feet. These lamps are to be placed on the lot line so that the illumination be not lost in the trees.

Riverside, Cal.—Definite action has been taken by the City Trustees toward installing an ornamental street lighting system on the main business streets of the city. All overhead wires on Main street from Sixth to Tenth and on several other principal avenues, will be removed and placed under ground.

Los Angeles, Cal.—The City Gas Company has ordered materials for the erection of a complete plant, and as soon as they arrive actual work will commence. Every effort will be made to have the plant in working order before the cold weather this fall, and the mains of the company will be extended as soon as the pipes can be laid.

Vallejo, Cal.—Owing to the continued agitation here for a better service and lower rates for electric lights and power, the application of Henry Brown for a franchise to run lines over the county highways in Napa County, including a line on the Vallejo road as far as the Solano County line, has attracted more than passing attention. K. Casper, who made his start in the electric field in Grass Valley pprior to the advent of the Bay Counties Power Company, owns the local system. Some are of the opinion that the Great Western Power Company of Oroville is behind the application of Brown.

San Francisco.—The loss at the plant of the gas company, which was damaged by fire April 2, is not so large as was at first supposed. F. V. T. Lee, assistant to the president of the company, says: "I think that $250,000 will easily cover the loss. It is hard to estimate the exact damage, but I am sure that it will not exceed that figure." Chief Engineer F. H. Varney, who was in charge of the station, says: "All the generators are practically intact and will be running immediately. The greatest damage was caused by the fall of 400 tons of roofing. For a time we feared that our plant was totally ruined."

Fresno, Cal.—A mass meeting has been held in the Joss house here and preliminary arrangements were made for the formation of a gas company to be controlled by Chinese. The Mongolians claim that there has been discrimination against various parties in Chinatown, and believe that they can save money by having a company of their own. A site in the center of Chinatown has been secured and the price stated in the option is $1,400. The plant is to cost $14,000. To insure the stability of the company, those using power will be required to contract to stay with the Orient Company. The directors are confident of being able to make all stores come into the combine to buck against the San Joaquin Power Company, which is now supplying Chinatown.

FINANCIAL.

Anaheim, Cal.—The Section 2 Water Company has let a contract to Emmett & Dyer for installing two 12-inch wells. It is the intention of the company to install a 50 horsepower engine and develop 150 inches of water.

Los Angeles, Cal.—On April 1 the city council adopted the ordinance of intention and resolution declaring that the public interest demand bringing the waters of Owens River to this city, and that the cost will be $23,000,000, and that an election shall be called to vote upon an issue of bonds for that amount. It is expected that the election will take place near the end of May.

San Francisco, Cal.—Following the action that caused all members of its affiliated unions employed on the Fairmont Hotel to quit work, the Building Trades Council at its meeting last week expelled Electrical Workers' Union No. 6. The latter organization has withdrawn its men from the big hotel, and it is expected that the work will go on with the Building Trades Council in full control.

Riverside, Cal.—Because the Lake View Water Company has defaulted in the payment of interest on $65,000 worth of bonds, the Los Angeles Trust Company, the holder of the bonds, has been given permission to sell all of the property of the Lake View Company in the San Jacinto Valley. The property includes about 700 acres of land, together with flumes, pipe lines, reservoirs, and pumping plants, all of which were given as security for the payment of the bond issue and interest. The bonds were issued May 1, 1903, and payable in twenty years.

San Francisco, Cal.—In his testimony before the Grand Jury recently, Captain A. H. Payson, president of the Spring Valley Water Company, is reported to have said: "Spring Valley is on its last legs. It is crippled financially. The litigation with the city and the decree of forfeiture, while it is illegal, has served to impair our credit. People will not invest in Spring Valley bonds. San Francisco is in a serious predicament. What is to be done to protect the city's water supply and to guard against fire? Spring Valley stock is widely scattered among poor and rich. One assessment of $3 a share has been levied and collected. It would be a hardship to rush another assessment." Captain Payson asserted that practically all of the $840,000 raised by the $3 assessment has been spent, and that the company has sold its building at the corner of Stockton and Geary for $500,000 in order to get ready money for rehabilitation. He stated that the 25 per cent reduction on rates made by the Supervisors would be contested in the courts, alleging that it amounts to confiscation of the property. It was made evident that the company had not been guilty of bribery.

Tucson, Ariz.—At a meeting of the board of directors of the Tucson Gas, Electric Light and Power Company it was voted to increase the capital stock to $500,000 in order to provide for future construction, equipment, etc.

San Francisco, Cal.—The combined earnings of the United Railroads of San Francisco and the Philadelphia Company for 1905 and 1906 are as follows:

	1905.	1906.	Increase.
Gross earnings	$24,229,062	$24,533,603	$304,541
Operating expenses and tax,	12,535,503	12,746,041	210,538
Fixed charges, sinking fund, etc	6,614,289	6,849,550	235,261
Net earnings	11,693,559	11,787,562	94,003
Surplus	5,079,270	4,938,012	141,258

Monrovia, Cal.—An ordinance has been adopted providing for an issue of $20,000 bonds for the acquisition, construction and completion of a city pumping plant and accessories for the water system at the wells known as the Chapman Wells. Also the sum of $10,000 is to be raised for pipe lines and conduits and $5,000 for improving the present mountain pipe system.

POWER AND LIGHT PLANTS.

Lethbridge, Alta.—The Lethbridge Electric Co. has decided to expend $25,000 this year in improvements. M. Freeman, manager.

Boise, Ida.—The Great Shoshone & Twin Falls Water Power Co. has been organized with a capital of $1,500,000. W. S. Kuhn, president.

Bandon, Ore.—Edwin G. Ames and Hollopeter Bros. have been awarded the contract for the establishment of a light and power plant at this place.

Oregon City, Ore.—The Portland Railway Light & Power Co. will expend $100,000 in the erection of a new power plant on the east side of Willamette Falls.

Grass Valley, Ore.—Council has purchased an electric light plant from the Fairbanks-Morse Co. for $3,052. The plant is to be in running order in ninety days.

Salem, Ore.—General Manager Sykes, of the gas plant, announced that the plant will be entirely remodeled and converted into an oil burning plant at a cost of $20,000.

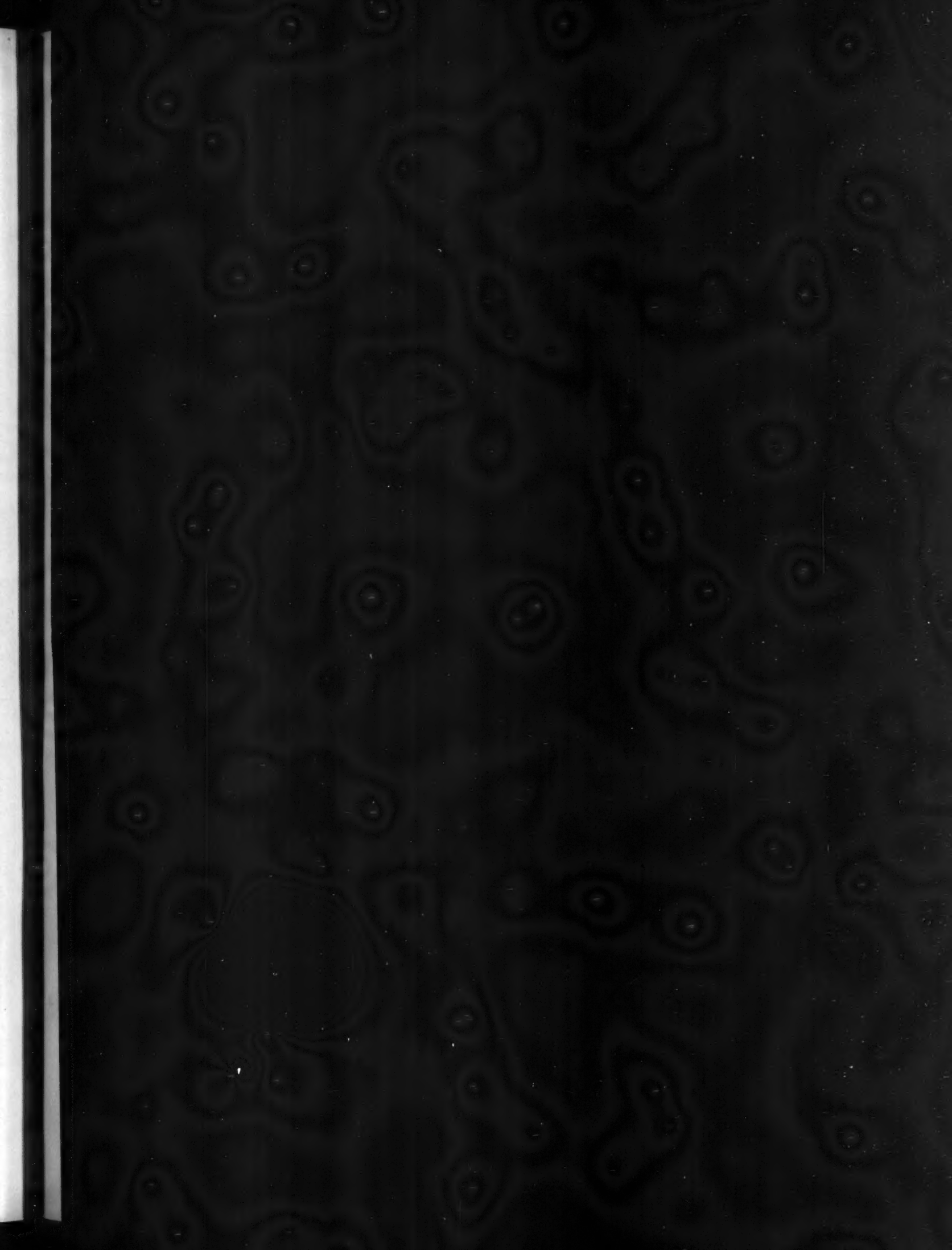
Waitsburg, Wash.—The Waitsburg Electric Light Company, capital $350,000, has been incorporated by Arthur T. Roberts, Emmett R. Henderson and C. E. Bateman.

Wallace, Ida.—The Inland Power Company, capital $300,000, has been incorporated by G. Scott Anderson, S. P. Wright, W. H. Hall, J. J. Maloney and W. W. Bacon.

Seattle, Wash.—The Seattle-Tacoma Power Co. has applied for a new franchise till 1930 to furnish steam heat and hot water to the business district bounded by Madison Street, Fifth Avenue, Pike Street and the water front.

Tacoma, Wash.—The Mendenhall Power Company, capital $1,000,000, has been incorporated by W. J. Sutherland, B. M. Behrends, R. T. Laffoon, M. L. Clifford and L. J. Pentecost. Principal place of operating department, Juneau, Alaska.

Prince Albert, Sask.—Council has awarded contracts to Goldie & McCullough, Montreal, Allis-Chalmers, Montreal, and the Canada Foundry Co., Ltd., Montreal, for improvements and extensions to the electric lighting plant to cost $26,237.

New Westminster, B. C.—W. V. Hunt, Vancouver, of the B. C. Electric Railway Co., has been appointed engineer in charge of the work of installing the new water power units at Lake Huntington. Three units of 10,000 horsepower each will be added at a cost of $250,000. R. H. Sterling, Vancouver, is general manager.

Spokane, Wash.—W. H. Wilcox, manager of the Home Telephone Company, announces that the phone numbers used by his company will be identical with those employed by Pacific States Company. Numbers containing four numerals will be the same on the two systems, with the exception that a letter will be substituted for the "Main," and where the number now in use contains only three numerals an additional number will be prefixed.